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**Subject: Draft Quality Assurance Project Plan
Yerington Mine Site, Lyon County, Nevada**

Dear Art:

Atlantic Richfield Company has prepared the attached Draft Quality Assurance Project Plan for the Yerington Mine Site.

If you have any questions regarding the Draft QAPP, please call me at 1-406-563-5211 ext. 430.

Sincerely,

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Draft

QUALITY ASSURANCE PROJECT PLAN

DECEMBER 5, 2002

PREPARED FOR:

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PREPARED BY:

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SECTION 1.0

INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Atlantic Richfield Company to serve as “over-arching” guidance for data collection and analytical activities to be conducted as part of site investigations at the Yerington Mine Site in support of mine closure, pursuant to the Closure Scope of Work (SOW). The SOW (Brown and Caldwell, 2002a) is attached as Appendix A to this QAPP and provides background information for the site and describes the proposed Work Plans for site investigations. Each Work Plan includes additional specific site information, and describes quality assurance issues for the specific data collection and analytical activities described in that Work Plan.

The SOW will be conducted pursuant to an Administrative Order on Consent between NDEP and Atlantic Richfield. Regulatory agencies involved in the Yerington Mine Site include the Nevada Division of Environmental Protection – Bureau of Corrective Actions (NDEP), the U.S. Environmental Protection Agency (EPA) and the U.S. Bureau of Land Management (BLM). These agencies and other members of the Yerington Technical Work Group (YTWG) review all submitted Work Plans for content and accuracy, including quality assurance (QA) and quality control (QC) content. Site safety information is also included in each Work Plan.

This QAPP presents general guidance for the Data Collection and Analysis section presented in each Work Plan, which may be modified for specific Work Plans. Topics addressed in this QAPP include:

- Field Methods and Procedures
- Documentation and Shipment of Collected Samples
- Laboratory Methods and Procedures
- Disposal of Sampling Materials

Field Methods and Procedures describes standard operating procedures (SOPs) for the collection of soil, sediment, groundwater, surface water and air samples. These SOPs include a description

of instruments used in the field to measure various parameters and the procedures used to calibrate the instruments, preparation of quality control (QC) samples such as blanks and duplicates, and decontamination procedures.

Documentation and Shipment of Collected Samples describes the procedures involved with accurate recording of field activities and sample and chain-of-custody, proper packaging of samples, and sample handling and transport.

Laboratory Methods and Procedures provides the general requirements necessary to achieve proper laboratory QA/QC for analysis of soil, sediment, groundwater, surface water and air. These requirements include the methods and detection limits necessary for each type of medium collected, the format that will be used to report data analysis results and QA/QC results, and the training and certification for laboratory personnel.

SECTION 2.0

FIELD METHODS AND PROCEDURES

The following Sections 2.1 through 2.5 provide field methods and procedures for each medium type: soil, sediment, groundwater, surface water, and air. Each section consists of sub-sections that describe:

- Equipment and Calibration
- Field Parameter Measurements
- Sample Collection
- Sample Identification and Preservation
- Decontamination Procedures

Duplicate samples, rinsate blanks, and field and trip blanks are discussed in Section 2.6. Training and Certification for field and laboratory personnel is covered in Section 2.7, and a Summary of Sample Collection and Storage Parameters is provided in Section 2.8.

2.1 Solids Sampling SOP

Rationale for selecting solids or soil sampling locations will be presented in each Work Plan.

2.1.1 Equipment and Instrument Calibration - Solids

Equipment and instruments used for solids sampling and field monitoring include, but are not limited to:

- pH (probe/meter)
- Photo-ionization detector (PID) (meter)
- Excavation and collection devices (e.g. hand shovel, core borer, hand auger, piston collector, split-spoon)

Manufacturer-supplied calibration information for each field instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed using the same

standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different subsurface conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

2.1.2 Field Parameter Measurements - Solids

The solids parameters to be measured in the field at the Yerington Mine Site are generally pH and organic vapors. Results from field screening activities are generally used to determine whether any additional excavation or drilling and sampling activities are necessary to delineate the vertical or lateral extent of impact.

Field screening measurements will be recorded on the appropriate excavation log and in the field notebook during the investigation. Logs of screening measurements will be used together with laboratory results to estimate the vertical extent of impact to the subsurface.

Organic Vapor Testing

For areas where organic vapor measurements are taken, portions of each soil sample will be placed in sealed clear plastic zip-loc bags and allowed to sit in direct sunlight to generate vapor, evidenced by condensation on the interior surface of the plastic bag. Organic vapor readings will then be performed with a portable organic vapor monitor (OVM) equipped with a photo ionization detector (PID) by inserting the OVM inlet into the plastic bag and recording the maximum vapor reading in parts per million by volume (ppm-v). Organic vapor measurements will be recorded on the appropriate excavation log during the investigation.

pH Testing

For pH testing, a paste will be formulated in the field with distilled water, and pH readings will be performed with a field pH meter. Measurements of pH will be recorded on the appropriate excavation log during the investigation.

2.1.3 Sample Collection - Solids

Excavation Sampling

Soil samples will be collected from each excavation by grab sampling of the backhoe bucket or from the hand auger or shovel. Sample collection depth is specific to each Work Plan. Sample collection locations will depend on the overall excavation depth, constituents of concern, and ease of sampling, and will be conducted in accordance with the individual Work Plan. Samples collected from a hand auger or from a backhoe or excavator bucket will be collected using a clean, decontaminated trowel or small hand shovel. Transfer of the samples from the trowel or shovel to the sample container will be accomplished with minimum disturbance of the solids. A minimum of one soil sample per sample location will be submitted for laboratory analysis.

Point Sampling

Soil samples will be collected from each point location by a discrete interval sampling technique such as borehole drilling in conjunction with split-spoon sampling or subsurface probe sampling. Sample collection intervals will depend on the overall sampling depth, constituents of concern, and ease of sampling, and will be conducted in accordance with the individual Work Plan. Collected soil samples will be transferred by hand from the split-spoon, probe casing, or other collection device to the sample container, minimizing disturbance of solids. Hands should be covered with clean, disposable, latex gloves. All collection equipment will be decontaminated between collection points.

Composite Samples

Each discrete solids sample that is combined with others into a single composite sample will first be either (a) weighed on a scale or (b) measured in a graduated volumetric container, then transferred to a plastic or metallic mixing tray. The combined equal-weight or equal-volume aliquots will be mixed together thoroughly with the trowel or hand shovel.

Collected samples will be placed in labeled containers appropriate for each analysis. (Refer to Section 2.1.4 for labeling protocols).

VOC Samples

The most important procedure in sampling solids containing volatile organic compounds (e.g., petroleum products or solvents) is to maintain the sample in an intact form from the time of collection to analysis if at all possible. This may be accomplished, for example, with

encapsulated core samples (in tubes) by capping the ends of the tubes and wrapping with a non-reactive sealant such as cellophane and teflon tape, then placing in a zip-loc plastic bag with the air evacuated. When maintenance of an intact solid sample cannot be accomplished, the person collecting the sample should expose the sample to the air for as short an amount of time as possible.

For volatile constituents analysis the collected material should be compressed into the container with a clean instrument or by hand covered with a clean, sterile, disposable latex glove, to evacuate air space. The container should be completely filled to minimize head air space, and sealed tightly with the container lid. The sealed container should be placed inside a sealed plastic zip-loc bag. Materials collected for pH analysis may be collected in the same manner.

All soil samples to be analyzed will be immediately placed into insulated chests with ice for transport under chain-of-custody to a Nevada-certified analytical laboratory. Soil field data and sample collection intervals will be recorded on the appropriate excavation log and in the field notebook during the investigation. Soil data will include soil color, moisture content, consistency, and a visual estimate of Unified Soil Classification.

Table 2-3, Section 2.8, outlines the proper amounts and containers for solids collection for various analyses.

2.1.4 Sample Identification and Preservation - Solids

Sample Identification

Sample labels will be completed with a permanent waterproof marker and attached to each laboratory sample container before each sample is collected, and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed

- Sample substance type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample is collected. This field identification number will consist of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, hypothetical soil sample collected below the North Evaporation Pond during the third sampling event at the fourth location sampled might be labeled: 003NEP004. Blanks and duplicate samples will be labeled in the same fashion as regular samples, with no indication of their contents. For example, the duplicate sample to the one stated above might be labeled: 003NEP006, with documentation in the field notebook that 003NEP004 and 003NEP006 are duplicate samples.

Sample Preservation

Unless otherwise specified for particular analysis methods, soil samples will generally not require addition of preservatives. If the addition of a preservative is required, it should be addressed in the Sample Preservation section of the individual Work Plan.

2.1.5 Decontamination Procedures - Solids

The following is a procedure that has been recommended by the EPA Region IX for the decontamination of sampling equipment:

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- 0.1 N nitric acid rinse and distilled water rinse (only when sampling for metals)
- Pesticide-grade solvent (reagent grade hexane) rinse and distilled water rinse (only when sampling for organic compounds)

All soil collection (sampling) equipment will be decontaminated between each excavation. For soil sampling, disposable scoops will be used or sampling equipment will be decontaminated

between each sampling location. In general, sampling equipment will be hand-washed with a solution of tap water and Alconox detergent, then double-rinsed in clean tap water. The decontamination wash should be accomplished with clean buckets, filled half to three-quarters full as follows:

- Bucket 1: Tap water with non-phosphate detergent such as Alconox
- Bucket 2: Clean tap water or de-ionized water.
- Bucket 3: Clean tap water or de-ionized water.

Equipment decontamination consists of the following general steps:

- Removal of gross (visible) contamination by brushing or scraping.
- Removal of residual contamination by scrub-washing in Bucket #1,
- Rinsing in Bucket #2, then rinsing in Bucket #3. Change the water periodically to minimize the amount of residue carried over into the third rinse.

All washing and rinsing solutions are considered investigation derived waste and will be placed in containers. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

2.2 Sediment Sampling SOP

Rationale for selecting sediment sampling locations will be presented in each Work Plan.

2.2.1 Equipment and Instrument Calibration - Sediments

Equipment and instruments used for sediment sampling and field monitoring include, but are not limited to:

- pH (probe/meter)
- Photo-ionization detector (PID) (meter)
- Excavation and collection devices (e.g. hand shovel, piston collector)

Manufacturer-supplied calibration information for each field instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed using the same

standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different sediment conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

2.2.2 Field Parameter Measurements - Sediments

Refer to Section 2.1.2, Field Parameter Measurements - Solids for QA procedures relative to field parameter measurements for sediments.

2.2.3 Sample Collection - Sediments

Ideal sediment sampling locations in flowing channels will be backwater areas if they exist, near the inner bank of a channel bend, near the bank in straight portions, or near pilings or other flow obstructions. These areas generally have the slowest moving water for a given reach and sediments will tend to settle here. Sediment sampling will progress from downstream to upstream locations in order to reduce the impact of sediment disturbance on subsequent samples (EPA, 1995).

At each sample location, sub-samples will be collected using one of two methods, in order of preference:

1. Using a core boring tool or piston-type sampler to retrieve a continuous core sample from zero to six inches below ground surface at each location and mixing that core sample into a representative composite sample, or if that method is not possible,
2. Using a trowel or small hand shovel to retrieve samples at depths of two, four, and six inches below ground surface, and combining them into one composite sample for that location.

The piston-type hand sampler consists of an approximately 3-inch diameter solid steel tube with a T-handle welded to the top. The hand-held sampler is pushed and twisted into the sediments while the plunger is drawn upwards. When the sampler is 6 inches into the sediments, it will be slowly withdrawn.

The following is a brief summary checklist for sediment sampling, based on the sampling protocol outlined above:

1. Select the sample location after surface water sample has been collected. Be certain to not collect samples from where ground surface has been disturbed, either by previous human or animal activity, or by where the sampler has walked.
2. Wear a new pair of latex gloves prior to each sampling location. Place indelible identifying label on the container.

For core boring samples:

3. Push the core boring barrel straight down into the bank or exposed channel sediments to a depth of six inches.
4. Transfer the extracted core sample from the barrel to the shallow HDPE mixing pan by carefully pushing out the entire solid medium in the barrel, using a gloved hand or decontaminated instrument.

For hand-dug samples:

5. Using a clean trowel or small hand shovel, dig straight down into the bank or exposed channel sediments to depths of two, four, and six inches below ground surface. At each depth interval, collect enough solid media to fill a clean, eight-ounce laboratory (the same jar may be used for all three depth intervals at one location).
6. At each depth interval, transfer the solid medium from the jar to the shallow HDPE mixing pan.

Mixing and transfer:

7. Thoroughly mix the core sample or all sub-samples together using the trowel or small hand shovel.
8. Using the trowel, transfer the resulting composite sample from the mixing pan to the labeled laboratory sample jars. Seal each jar with a teflon-lined lid.
9. Place each sealed jar into a zip-loc bag and store in an insulated ice chest.
10. Decontaminate trowel or hand shovel and mixing pan, and dispose of gloves as described in Section 2.2.5.

If sediment is to be analyzed for volatile compounds, the samples to be analyzed for volatile compounds should not be homogenized but rather transferred directly from the sampler into the sample container (EPA, 1995).

2.2.4 Sample Identification and Preservation - Sediments

Sample Identification

Sample labels will be completed with a permanent waterproof marker and attached to each laboratory sample container before each sample is collected, and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample substance type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample is collected. This field identification number will consist of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, the hypothetical sediment sample collected in the Wabuska Drain during the first sampling event at the fourth location sampled might be labeled: 001WD004. Blanks and duplicate samples will be labeled in the same fashion as regular samples, with no indication of their contents.

Sample Preservation

Unless otherwise specified for particular analysis methods, sediment samples will generally not require addition of preservatives. The exception to this may be acid preservation for dissolved metals if the sediment sample is liquefied and will be analyzed as a water sample. If the addition of a preservative is required, it should be addressed in the Sample Preservation section of the individual Work Plan.

2.2.5 Decontamination - Sediments

Refer to Section 2.1.5, Decontamination - Solids Sampling for QA procedures relative to decontamination of sediment sampling equipment.

2.3 Groundwater Sampling SOP

The following procedures describe standard operation procedures for collection of groundwater samples. Groundwater samples are typically discrete samples, collected for the purpose of evaluating parameters at a particular well location; as such, groundwater samples are not composited. Particular attention should be given to decontamination procedures, since there exists a high potential for cross-contamination and equipment contamination with water sampling.

2.3.1 Equipment and Instrument Calibration - Groundwater

Equipment and instruments used for groundwater sampling and field monitoring may include, but are not limited to:

- Temperature/pH/conductivity (probe/meter)
- Dissolved oxygen (probe/meter)
- Groundwater level indicator (probe/audible indicator)
- Purging devices (e.g. pumps or bailers)
- Sampling devices (e.g. pumps or disposable bailers)

Manufacturer-supplied calibration information for each instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed using the same standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different groundwater conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

2.3.2 Field Parameter Measurements - Groundwater

Field measurements of groundwater at monitor wells may include static groundwater elevations, dissolved oxygen, pH, electrical conductivity and temperature. The field parameter measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments.

Prior to sampling at each monitor well, the pH, dissolved oxygen, temperature, and electrical conductivity probe(s) will be calibrated and the conductivity probe will be checked with a standard (Section 2.3.1). Proper operation of the groundwater elevation probe will be checked prior to use by immersing the probe in water to ensure the audible signal is produced. The methods and minimum detection limits of the pH, dissolved oxygen, temperature, and electrical conductivity devices are shown below:

Table 2-1. Groundwater Field Parameters		
Parameter	Method	Detection Limit
Conductivity	EPA 120.1, meter	1.0 μ S/cm
Dissolved Oxygen	EPA 360.1, probe	0.1 mg/l
PH	EPA 150.1, meter	0.1 standard units
Temperature	Standard Methods 212, Thermometer	0.1 $^{\circ}$ C

Field parameters will be measured in one day to limit error in calculating hydraulic gradient or flow direction due to potential diurnal fluctuations in groundwater elevation, and will be recorded in a bound field notebook. Measurement of field parameters in monitor wells will occur in order of least contaminated to greatest contaminated, as determined by the previous quarter's laboratory analytical results. All equipment used to measure depth-to-water and other physical parameters in each well will be decontaminated between wells by washing in an Alconox detergent solution with subsequent clean-water rinse.

2.3.3 Sample Collection - Groundwater

Field measurements will be collected in monitor wells prior to groundwater sample collection (Section 2.3.2). Monitoring wells will be purged using either a submersible pump or clean, disposable Teflon bailer, depending on depth-to-water, total depth of the well, and well diameter. Domestic wells will be sampled at the tap or other source on the property. The equipment and purging method used for monitor wells will be noted on each field data sheet.

During purging, pH and electric conductivity will be monitored with a calibrated, portable field instrument in order to determine stabilization of these parameters between each purged well casing volume. Three consecutive measurements that display stable values of pH and

conductivity will be recorded prior to sampling. Stable value is defined as pH that does not vary by more than 0.2 pH units, and specific conductance that does not vary by more than 10 percent from reading to reading (EPA, 1995).

A minimum of three casing volumes will be purged from each well. If pH and conductivity have not stabilized after five casing volumes have been purged (30 minutes if the purge volume is not known), purging will cease, a notation will be recorded in the field logbook and samples will be collected. If a well is purged dry, no sample will be collected until it has recharged to within 80 percent of its original depth-to-water, or no more than 24 hours. For large-capacity wells, samples may be collected after field parameters have stabilized, prior to the purging of three casing volumes.

After pH and conductivity have stabilized, a groundwater sample will be collected using a disposable Teflon bailer or discharge from the submersible pump. If samples are to be analyzed for volatile organic compounds, a pump flow rate of less than 100 milliliters per minute is recommended to minimize volatilization (EPA, 1995). Vials for volatile organic compound analysis will be filled first to minimize aeration of water in the well. The sample will be decanted into an appropriate sample container depending on the required analysis. Both filtered samples for dissolved metals and, for selected monitor wells and domestic wells, unfiltered samples for total metals will be each collected in 500-milliliter (mL) bottles. Non-metals samples will be collected in 1,000-mL bottles, unfiltered, with no acid preservation. Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

Sample bottles for the blank will not be triple-rinsed prior to being filled, so that any contamination from bottles alone would be detected. Immediately following collection, samples will be placed into an insulated cooler chilled with ice to an approximate temperature of four degrees centigrade. The samples will then be transported to the analytical laboratory via overnight mail or personal delivery.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.3.4 Sample Identification and Preservation - Groundwater

Sample labels will be completed and attached to each laboratory sample container prior to groundwater collection. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection.

The labels will be filled out with a permanent marker and will include the following information:

- Sample identification (well location)
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, a hypothetical groundwater sample collected during the third sampling event at monitor well MW-4 would be labeled: 003MW004. Blanks and duplicate samples for quality assurance will be labeled in the same fashion, with no obvious indication of their sample location or quality. For example, the duplicate sample to the one stated above might be labeled: 003MWD111, with a field notebook note that this identification number corresponds to 003MW004.

The following sample preservation methods will be followed for collected groundwater samples:

- Total Metals: A test vial will be prepared by adding a measured volume of nitric acid (HNO₃) to a typical sample container of groundwater, to determine the amount of acid needed to lower the pH to less than 2. The appropriate amount of HNO₃ will then be added to the sample vials prior to the addition of the sample. Check the pH by pouring a very small amount of sample into the bottle cap and checking the pH with pH paper.

Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

- Dissolved Metals: Filter sample through a 0.45 micron filter using a disposable form of inline filter immediately after sample collection. Following filtration, add nitric acid to a pH less than 2. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.
- Volatile organic compounds: A test vial will be prepared by adding a measured volume of hydrochloric acid (HCl) to a typical sample container of groundwater, to determine the amount of acid needed to lower the pH to less than 2. The appropriate amount of HCl will then be added to the sample vials prior to the addition of the sample. The vials will be filled, capped, then inverted and checked for air bubbles to ensure zero headspace. If a 1/8-inch or larger air bubble appears, the vial contents will be emptied into the measured container, the vial discarded, and a new sample will be collected. Cool the sample to 4°C with ice immediately after sample collection.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.3.5 Decontamination - Groundwater

The following is a procedure that has been recommended by the EPA Region IX for the decontamination of sampling equipment:

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- 0.1 N nitric acid rinse and distilled water rinse (only when sampling for metals)
- Pesticide-grade solvent (reagent grade hexane) rinse and distilled water rinse (only when sampling for organic compounds)

Buckets should be placed on plastic sheeting to prevent spillage to the ground, and to help keep the decontamination area and equipment as clean as possible. The buckets should be filled half to three-quarters full as follows:

Bucket 1: Tap water with non-phosphate detergent such as Liqui-Nox

Bucket 2: Clean tap water or de-ionized water.

Bucket 3: Clean tap water or de-ionized water.

After the decontamination area is set up, equipment decontamination of soil sampling equipment is comprised of four general steps:

1. *Removal of gross (visible) contamination.* Gross contamination generally applies to soil sampling equipment, which may have significant residue clinging to the piece of equipment. This can be removed by drybrushing or scraping or water rinse.
2. *Removal of residual contamination.* All sampling equipment used at the site must be cleaned prior to any sampling effort, after each sample is collected, and after the sampling effort is accomplished. Removal of residual contamination consists of the following steps:
 - a. Place the item in the first bucket (detergent wash) and scrub the entire surface area of each piece of equipment to be decontaminated. Utilize scrub brushes to remove all visible contamination. Change the water periodically to minimize the amount of residue carried over into the second rinse.
 - b. Place the item in the second bucket (clear water rinse – tap or deionized water) and rinse. Change the water periodically to minimize the amount of residue carried over into the third rinse.
 - c. Place the item in the third bucket (deionized or distilled water) and repeat the rinsing procedure. Change water as necessary.
 - d. Place the item on a clean surface such as plastic sheeting to await reuse or packaging for storage (e.g., wrapping foil).
3. *Prevention of recontamination.* After the decontamination process, equipment should be stored to preserve its clean state to the extent practical. The method will vary by the nature of the equipment. Protection measures include covering or wrapping in plastic or sealable plastic bags, or wrapping with oil-free aluminum foil.
4. *Disposal of wastes associated with the decontamination.* All washing and rinsing solutions are considered investigation derived waste and should be containerized. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Decontamination of purging equipment is performed between each well by submerging and scrubbing the outside of the pump and associated hosing in an Alconox detergent bath, then twice rinsing the outside of the pump in deionized water. At least five gallons of Alconox detergent solution and then five gallons of deionized water are run through the internal portion of the pump to reduce the potential of cross contamination between wells.

All purged groundwater will be poured on the ground on-site and decontamination water will be collected in approved containers and properly disposed of or recycled. For each groundwater sampling event, the information described in Section 4.0, will be recorded.

2.4 Surface Water Sampling SOP

The following procedures describe standard operation procedures for collection of surface water samples. Surface water samples are typically discrete samples, collected for the purpose evaluating parameters at a particular location along a body of water, and are not typically composited. Particular attention should be given to decontamination procedures, since there exists a high potential for cross-contamination and equipment contamination with water sampling of any kind.

2.4.1 Equipment and Instrument Calibration - Surface Water

Equipment and instruments used for surface water sampling and field monitoring may include, but are not limited to:

- Temperature/pH/conductivity (probe/meter)
- Dissolved oxygen (probe/meter)
- Flow rate (flumes or probe/meter)
- Sampling devices (e.g. pumps or disposable bailers)
- Tape measure
- Waders or hip boots

Manufacturer-supplied calibration information for each instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed using the same standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different surface water conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

2.4.2 Field Parameter Measurements - Surface Water

Field measurements of surface water in rivers, streams, ponds, or other forms of open containment may include some combination of dissolved oxygen, pH, electrical conductivity and temperature, depending on the nature of the water source. The exact types of field measurements

will be specified in the individual Work Plan. The field parameter measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments.

Prior to sampling, the pH, dissolved oxygen, temperature, and/or electrical conductivity probe(s) will be calibrated and the conductivity probe, if used, will be checked with a standard (Section 2.4.1). The methods and minimum detection limits of the pH, dissolved oxygen, temperature, and electrical conductivity devices are shown below:

Table 2-2. Surface Water Field Parameters		
Parameter	Method	Detection Limit
Conductivity	EPA 120.1, meter	1.0 μ S/cm
Dissolved Oxygen	EPA 360.1, probe	0.1 mg/l
pH	EPA 150.1, meter	0.1 standard units
Temperature	Standard Methods 212, Thermometer	0.1 $^{\circ}$ C

Field parameters will be measured in one day to limit error in calculating flow rates due to potential diurnal fluctuations in river or stream elevation, or in diurnal fluctuations of temperature and dissolved oxygen. All measurements will be recorded in a bound field notebook. The physical measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments. Instrument accuracy limits will be specified in the results section of the Data Summary Report.

Measurement of field parameters in ponds or other open containment will occur in order of least contaminated point to greatest contaminated point, as estimated by observation, or determined by previous laboratory analytical results, if available. Field parameters will be measured after each sample collected, to avoid possible cross-contamination at the sample location. All equipment used to measure physical parameters at each sampling point will be decontaminated between points by washing in an Alconox detergent solution with subsequent clean-water rinse.

Measurements of surface water conductivity, dissolved oxygen, pH, and temperature will be collected from two to three inches below the water surface, unless specified otherwise in the individual Work Plan. Temperature and conductivity surface water measurements will be

collected by placing the test cup and probe below the water surface. Measurements of surface water pH, dissolved oxygen and electrical conductivity will be collected by placing the probe below the water surface, allowing the pH value to stabilize, and recording the value. In rivers, streams, or ponds, care will be taken to prevent disturbance of sediment or soil along the bank that could roll down into the water.

Channel Flow

Channel flow will be measured with either a cutthroat flume or Pygmy current meter. The flume will convey a flow of about 2.3 cubic feet per second (CFS) without overtopping. The flume will be temporarily placed in the conveyance, leveled and allowed to equalize flow between the inlet and outlet prior to recording the stage in the flume. A typical flume has a staff gage installed on the flume that is scaled in 0.01-foot increments. The recorded stage is converted to flow rates using a rating table.

An eight-inch flume will be used for flow measurements in the range from 0.2 gpm to 1000 gpm when site conditions permit. If lower tolerances are required, then a one to four-inch flume may be used. The one-inch flume is capable of flow measurements down to 0.0225 gpm.

For flows greater than 2.3 CFS a pygmy current meter will be used to determine flow rate. The meter is a rotating element type in which the operation is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter rotor.

In general, the 6/10 method will be used for measuring flow rate, whereby the velocity measurement at 6/10 of the total vertical depth of the channel from the channel surface is used to measure velocity. This method applies to flow depths up to 2.5 feet deep. In deeper water the 2/10 and 8/10 method may be applied, whereby two measurements at each depth are used to obtain an average channel velocity.

At the specified channel cross section the top width of the flowing channel will be measured then divided into equal increments for determining incremental channel width, depth and velocity. The mid-point method will be used for determining average channel velocity. The product of the width and depth provides the area for each section and the current meter yields the velocity for the section. The sum of the increments equals the total flow.

2.4.3 Sample Collection - Surface Water

Samples at each monitoring point will be collected prior to recording field parameters or measuring flow. Unless specified otherwise in the individual Work Plan, high-density polyethylene (HDPE) bottles, supplied the analytical laboratory, will be used to collect surface water samples. Prior to collecting the actual lab sample, the collection bottle will be marked with a collection sequence number, and triple-rinsed with the water source being sampled. In moving water, the water samples will be collected slightly “upstream” of where the bottles are rinsed, to prevent disturbed sediment from contaminating the sample.

Water samples will be collected from just below the water surface, taking care to avoid sampling where surface debris is present. Care will also be taken to prevent disturbance of bed sediment or soil along the banks of rivers, streams, or ponds that could roll down into the water. Latex gloves will be used to handle bottles and equipment throughout each sampling event. The gloves will be changed between each sample point.

Sample collection containers, preparation, and preservation is outlined in Table 2-3, Section 2.8. Both total metals (unfiltered) and, dissolved metals (filtered) samples will be each collected in 500-milliliter (mL) bottles. Non-metals samples will be collected in 1,000-mL bottles, unfiltered, with no acid preservation. Sample bottles for the blank will not be triple-rinsed prior to being filled, so that any contamination from bottles alone would be detected.

The following is a brief summary checklist for surface water sampling, based on the sampling protocol described above:

1. Locate accessible portions of the body of water where access and sampling activities create minimal disturbance to the water that will be sampled. In streams and rivers, flowing water is required for sampling.
2. Wear a new pair of latex gloves prior to each sampling point. Place an indelible identifying mark or label on the container. Fill container directly by carefully submerging the mouth of the container two to three inches below the water surface. In flowing water, sample into the flow, with the body of the container and hand downstream of bottle mouth. Adjust the container position as needed to obtain a nearly full container (a small head-space may remain).
3. Thoroughly rinse container, dumping out downstream of where sample will be collected. Repeat two more times.

4. Unfiltered Samples: Collect the sample in same manner as #2, rinse the cap in flow or just below water surface, seal the container, and wipe off the outside with a clean paper towel.
5. Filtered Samples: Collect the sample in the same manner as #2, and perform steps #2 and #3 for an additional empty bottle to filter into. Using an in-line pump with a new 0.45-micron filter and new line, carefully filter the water from the full bottle into the empty one. Perform this activity away from the body of water, taking care not to allow unfiltered water present on surface exteriors to enter the filtered water bottle. Use a fresh pair of gloves for the filtering procedure. Replace the cap, seal the container, and wipe off the outside with a clean paper towel.
6. Measure and record flow, pH, conductivity, and temperature, as appropriate.
7. Preserve all samples as appropriate, complete documentation, package and ship or transport samples.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.4.4 Sample Identification and Preservation - Surface Water

Sample labels will be completed and attached to each laboratory sample container after each sample is collected, to avoid saturation of the labels during water collection. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification (well location)
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, a hypothetical sample collected at the Yerington Pit Lake during the third sampling event at the first location sampled would be labeled: 003YPL001. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their contents (Section 2.6).

The following sample preservation methods will be followed for collected surface water samples:

- Total Metals: A test vial will be prepared by adding a measured volume of nitric acid (HNO_3) to a typical sample container of groundwater, to determine the amount of acid needed to lower the pH to less than 2. The appropriate amount of HNO_3 will then be added to the sample vials prior to the addition of the sample. Check the pH by pouring a very small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.
- Dissolved Metals: Filter sample through a 0.45 micron filter using a disposable form of inline filter immediately after sample collection. Following filtration, add nitric acid to a pH less than 2. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.
- Volatile organic compounds: A test vial will be prepared by adding a measured volume of hydrochloric acid (HCl) to a typical sample container of groundwater, to determine the amount of acid needed to lower the pH to less than 2. The appropriate amount of HCl will then be added to the sample vials prior to the addition of the sample. The vials will be filled, capped, then inverted and checked for air bubbles to ensure zero headspace. If a 1/8-inch or larger air bubble appears, the vial contents will be emptied into the measured container, the vial discarded, and a new sample will be collected. Cool the sample to 4°C with ice immediately after sample collection.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.4.5 Decontamination Procedures - Surface Water Sampling

For surface water sampling, all sampling equipment will be disposable or one-time use, with the exception of the in-line pump. Although the pump should not normally come in contact with water, decontamination of the pump between sample locations will occur using decontamination water dedicated for the pump. For decontamination of pumps and field instruments, refer to Decontamination Procedures for groundwater (Section 2.3.5).

2.5 Air Sampling SOP

The rationale for air quality sampling is presented in the Fugitive Dust Work Plan.

2.5.1 Equipment and Calibration - Air

In general, equipment and instruments used for air sampling and monitoring may include, but are not limited to:

- Temperature (sensor/meter)
- Organic carbon vapors (e.g., Photo-ionization detector)
- Outdoor air sampling devices (e.g. personal air pumps, PM-10 samplers)

Manufacturer-supplied calibration information for each instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed using a volumetric rate method and/or gas standards used to calibrate. The purpose of the drift check is to assess the change in flow or the loss of instrument sensitivity that often occurs when measurements are performed at different sample locations under different ambient air conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

During calibration, a closure plate perforated with a number of circular orifices is connected to the inlet of the sampler. The pressure drop across this orifice plate provides a measure of instrument air flow rate at any time. This pressure drop may be indicated by a rotameter, manometer, or other pressure-responsive device traceable to an NIST certified standard (EPA, 1999). All sampler filters must be visually inspected for defects, and defective filters must be

rejected if any are found. Batches of filters containing numerous defects should be returned to the supplier. Specific defects to look for are pinholes, loose material, non-uniformity or symmetry, or discoloration.

2.5.2 Sample Collection - Air

Sampling and monitoring will be conducted according to the Nevada Ambient Air Quality Monitoring Guidelines issued by the NDEP/Bureau of Air Quality and published EPA guidance and procedures for State and Local Air Monitoring Stations (SLAMS).

Collection and analysis methods may be either manual or automated (analyzers). For SO₂, particulates, and lead, the reference method for each is a unique manual method that is completely specified in 40 CFR Part 50 (Appendices A, B, and G respectively) (EPA, 1998c). Revised requirements for ambient air quality reference methods for particulate air sampling are provided in 40 CFR Parts 53 and 58. Installation of air sampling devices and equipment is covered in Section 6.3.

The following information will be obtained from all air sampling activities:

- Sampler identification
- Run date and time
- Type of sampler and model
- Elapsed run time (minutes)
- Actual flow rate (m³/min)
- Standard flow rate (m³/min)
- Calibration methods
- Minimum detection limit
- Maximum detection limit
- Filter serial number
- Gross filter weight (g)
- Tare filter weight (g)
- Net weight (g)
- Particulate concentration (ug/m³)

The reference method for PM₁₀ sampling will follow NDEP guidance. Additional guidance is given in 40 CFR Part 50, Appendix J and implemented in the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II," Section 2.11 and in the "Quality Assurance Guidance Document 2.11, Monitoring PM₁₀ in Ambient Air Using a High-Volume Sampler Method". The following procedure is recommended by NDEP and EPA (1999) for air sampling using a PM₁₀ high-volume air sampler, to be modified for the mid volume samplers to be used at the Yerington Mine Site:

1. Perform a laboratory check to determine if the sampler is operational. Turn on the sampler and observe the vacuum motor performance and shift the recorder response (if so equipped).
2. Carefully transport the sampler to the field site. Following manufacturer's instructions, carefully assemble the base and inlet of the sampler. The sampler must be bolted down to a secure mounting surface. Refer to Section 6.3 of this QAPP for specific sampler installation procedures.
3. Check all tubing and power cords for crimps, cracks, or breaks.
4. Plug the power cord into a line voltage outlet. The use of waterproof interlocking electrical connectors is recommended to ensure operator safety and to avoid shorts or power interruptions.
5. Turn on the sampler and make sure that it is still working properly. Investigate and correct any malfunctions before proceeding. Operate the sampler for approximately 30 min to ensure that the motor brushes are properly seated and that the motor is operating at full performance.
6. Perform a multipoint flow-rate calibration, as described in the instrument calibration manual. Do not make any change or adjustment on the sampler flow indicator after calibrating.
7. Remove the calibrating orifice. Mount the filter sheet in the filter holder taking care not to lose any of the fiber. Clamp it in place by means provided. Seal into place easier by facing the smooth side into the housing if there is a difference in texture. If the filter holder is separate from the sampler, mount the holder on the intake port, making sure that the coupling gasket is in place and that it is tight.
8. Place the sampler in the position and location called for in the test, which is with the filter face up, in a horizontal plane, and inside a housing. The dimensions and clearances specified are intended to provide uniformity in sampling practice.
9. Start the sampler motor and record the time and date. Note the temperature and barometric pressure. Read the flow-rate indicator and record this reading and the corresponding flow rate as read from the calibration curve. An electric clock should be connected to the same line as the motor so as to detect any loss of test time due to

- power interruption. A continuous record of the sampling flow rate and sampling time can be obtained by the use of a continuous pressure (or flow rate) recorder.
10. Allow the sample to run for the specified length of time, which is commonly 24 h, ± 1 h. During this period several readings of flow rate, temperatures, barometric pressure, and time should be taken if this is feasible. A final set of reading is taken at the end of the test period. If only initial and final readings are made, assume that change of readings is linear over the period of test. Intermediate readings will improve the accuracy of volume measurement.
 11. At the end of the sampling period, record all final readings. Remove the filter from the mount very carefully so as not to lose any of the fiber material or collected particulate matter. Fold the filter in half upon itself with the collected material enclosed within. Place the folded filter in a clean tight envelope or metal container and mark it for identification.

PM₁₀ filters will be weighed prior to and after sampling and after they have been allowed to equilibrate to temperature (between 15 and 30 °C) and humidity (20 to 45 percent) for 24 hours. An NDEP certified laboratory will perform the chemical analyses of the particulate matter collected on the filters on a quarterly basis. Particulate matter will be analyzed for metals using the X-Ray Fluorescence (XRF) Air Filter Analysis with the exception of beryllium, which must be analyzed using atomic absorption analysis. Teflon filters will be used to facilitate XRF spectroscopy for metals analysis.

The accuracy of mid-volume PM₁₀ samplers is assessed by auditing the flow rate of each sampler with an orifice transfer standard. Then the corrected sampler flow rate without an orifice transfer standard is compared to the design flow rate. Refer to the manufacturers' operation manual for calibration methods specific to each PM₁₀ sampler.

Sampling Periods and Frequency

Sampling will conform with the sixth-day particulate sampling schedule consistent with NDEP guidelines. Each sampler will be operated for 24 hours at least every designated sixth day throughout the year. For continuous ambient air quality monitoring data, at least 45 minutes of valid observations are required to represent an hourly average. Running averages of more than one hour will require valid observations for at least 75 percent of the hours in the averaging period.

Particulate Concentration

Mid-volume PM₁₀ sampling calculations will conform to the "Quality Assurance Guidance Document 2.11, Monitoring PM₁₀ in Ambient Air Using a High-Volume Sampler Method" or Section 2.11 of the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods (Interim Edition)." The concentration of PM₁₀ in the ambient air is computed as the total mass of the collected particles divided by the volume of air sampled.

The measured concentrations from all samplers will be reported including, as applicable, the percentage difference in concentrations between any two or more co-located samplers for concentrations above 80 µg/m³.

The current 24-hour PM₁₀ standard has been revised, based on the 3-year average of the 99th percentile of 24-hour PM₁₀ concentrations at each sampling location. The current annual PM₁₀ standard of 50 µg/m³ is met when the 3-year average of the annual arithmetic mean PM₁₀ concentrations at each monitor within an area is less than or equal to 50 µg/m³, with fractional parts of 0.5 or greater rounding up (NDEP 2000).

2.5.3 Sample Identification and Preservation - Air

All collected samples must be carefully removed from the monitoring device and placed in sealed, nonreactive containers. If the container is for air sample filters, it should be sealed by placing a piece of tape or a sticker over the top and bottom to avoid accidental opening of the container. The tape or sticker should act as a custody seal, and be labeled with the date, time, and initials of the field personnel. This sticker must adhere firmly to ensure that it cannot be removed without destruction. If the air sample container is a closed plastic bag of the sampled air itself, the same procedure will be followed, using an adhesive custody seal over the bag closure.

Sample labels will be completed and attached to each laboratory sample container prior to collection of the sample. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, a hypothetical sample collected along the west edge of the Sulfide Tailings during the third sampling event at the fourth location sampled would be labeled: 003STW004. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their contents (Section 2.6).

Sealed containers with air sample filters or bags of air should be placed inside an ice chest, with no ice. The presence of ice would cool the bags, allowing potential condensation, or may allow moisture to enter the filter containers, both undesirable occurrences. Sealed plastic bags of sampled air should be filled to less than full capacity to allow for expansion and contraction of the air and bag in case the samples are transported to a different elevation. This procedure will avoid potential bursting of the bag.

2.5.4 Decontamination Procedures - Air

All air sampling equipment will be cleaned between sampling events. Parts of mid-volume air samplers that have been exposed to sampled air flow will be cleaned in accordance with the manufacturers' instructions. Tubing on personal air samplers will be replaced with new tubing. Fresh air will be allowed to run through probes and meters in accordance with the manufacturers' instructions, and for a period of not less than two minutes.

2.6 Duplicate Samples and Blanks - All Sampling

The following sub-sections describe duplicate samples, rinsate blanks, and field and trip blanks that are prepared for the purpose of quality assurance.

2.6.1 Duplicate Samples

Duplicate samples will be collected at a frequency of one per every 10 samples for each analysis. Duplicate samples will be collected by filling the containers for each analysis at the same time the original sample is collected. In general, duplicate samples will be collected in the same manner as regular samples. For quality assurance purposes, duplicate samples will be labeled in the same fashion as regular samples, with no indication that they are QC samples. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent “blind” to the lab.

Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent “blind” to the lab. For example, a duplicate sample to 003NEP004 might be labeled 003NEP006, with documentation in the field notebook that 003NEP004 and 003NEP006 are duplicate samples.

Volatile Constituents in Soil

Samples collected for analysis of volatiles (e.g., petroleum or solvents) from excavations will be collected with a clean trowel and divided along each side of the trowel (left and right) into two separate sample containers. Samples collected from point sampling locations will be removed from the collection device (e.g., split-spoon or probe casing) and divided in half vertically over the interval to be collected for analysis. These methods are employed to minimize volatilization of volatile constituents that occurs during mixing.

Non-volatile Constituents in Soil

Samples collected for analysis of non-volatiles from either excavations or point sample locations will be collected in the same manner as previously described, then thoroughly mixed in a shallow plastic or metallic mixing tray with the trowel or hand shovel and transferred from the tray to separate sample containers.

2.6.2 Equipment Rinsate Blanks

In general, equipment rinsate blanks will be collected when reusable, non-disposable sampling equipment (e.g., water level probe) are being used for the sampling event. A minimum of one equipment rinsate blank is prepared each day when equipment is decontaminated in the field.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring laboratory-grade, certified organic-free water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix (e.g., soil, groundwater, etc.) each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for the same analytes as normal samples. The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described in Sections 2.6 and 5.1. A separate identification sample number will be assigned to each rinsate blank, and it will be submitted blind to the laboratory.

2.6.3 Field and Trip Blanks

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling procedures. For groundwater or surface water samples, field blanks will be created by pouring laboratory-grade de-ionized or certified organic-free water into a sampling container at one of the sampling points. For soil or sediment samples, field blanks will be created by transferring a known source of uncontaminated solid (e.g., commercial sterilized soil) into a sampling container at one of the sampling points. Field blanks will be collected at a frequency of one per every 20 samples, with a minimum of one blank for less than 20 samples.

The exact same collection procedures will be used for preparation of field blanks as was used for regular sampling. The field blanks that are prepared will be analyzed for the same analytes as regular samples. The field blanks will be preserved, packaged, and sealed in the manner described in the appropriate section for the type of medium being prepared. A separate identification sample number will be assigned to each blank, and it will be submitted blind to the laboratory.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the sample stream and if cross contamination in the form of migration has occurred among the collected samples. Groundwater and surface water trip blanks will be prepared by pouring distilled or de-ionized solvent free water into 40 milliliter (ml) vials prior to arriving at the site, sealing the vials and then transporting them to the site. Soil and sediment trip blanks will be prepared by transferring a known source of clean, uncontaminated solid into a four-ounce jar, and sealing the lid.

The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same insulated chest with the regular samples collected for analyses. The trip blanks will be preserved, packaged, and sealed in the manner described in the appropriate section for the type of medium being prepared. A separate identification sample number will be assigned to each trip blank and it will be submitted blind to the laboratory. Trip blanks will be collected at a frequency of one per sampling event per type of matrix, whether that event occurs over one day or several days.

2.7 Training and Certification - Field Methods and Procedures

Appropriate education and training are integral to any sampling or monitoring program that seeks to obtain reliable data. Personnel assigned to field sampling or monitoring activities are expected to have met the educational, work experience, and training requirements for the particular type of sampling or monitoring. In some cases, field activities require specific certification. Records on personnel qualifications and training should be maintained and should be accessible for review during all activities.

In general, training and certification for air, water, and soil monitoring and sampling is not required in the State of Nevada. However, Phase I Environmental Site Assessments and Underground Storage Tank closure and assessment work in the state of Nevada requires oversight by a Nevada Certified Environmental Manager.

Health and Safety Training

Subcontractor personnel working on any Atlantic Richfield mine site or associated site or facility must have successfully completed training appropriate for the working conditions. This may include some combination of:

- Hazardous waste site operations in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements specified in 29 CFR 1910.120(e) and 8 CCR 5192(e); and
- Mine operations safety in accordance with the Mine Safety and Health Administration (MSHA) Mine Act, Sections 115 and 302.

Specific Health and safety training is beyond the scope of this QAPP, and is covered in the Site Health and Safety Plan and in Job Safety Analyses specific for each Work Plan.

2.8 Summary of Sample Collection and Storage Parameters

For each type of media sampled, there are specific containers, preservatives, and storage conditions that are required. The following table summarizes the necessary containers, amount needed for analysis, maximum hold time, filtering and preservatives, and storage temperature.

Table 2-3. Summary of Sample Collection and Storage Parameters

Parameter	Amount for Analysis	Minimum filled cont. size	Filtering	Maximum Hold Time	Storage temperature	Preservatives
Groundwater and Surface Water						
Volatile Organic Compounds (including Total Petroleum Hyd.)	5 mL	(3) 40-mL glass vials	None	14 days	4°C	HCl to pH<2
Semi-volatile Organic Compounds	1,000 mL	(2) 1-liter amber glass	None	14 days	4°C	None
Total Dissolved Solids; Total Solids	1,000 mL	1,000 mL HDPE	None	7 days	4°C	None
Sulfate, Chloride, Bromide, Fluoride	500 mL	1,000 mL HDPE	None	28 days	4°C	None
Total Organic Carbon	100 mL	250 mL HDPE	None	28 days	4°C	HCl to pH<2
Phosphorous		250 mL HDPE	None	48 hours	4°C	H ₂ SO ₄ to pH<2
Nitrate	100 mL	250 mL HDPE	None	48 hours	4°C	None
				7 days	4°C	H ₂ SO ₄ to pH<2
Total Metals	Varies per metal	500 mL HDPE	None	6 months*	4°C	HNO ₃ to pH<2
Dissolved Metals	Varies per metal	500 mL HDPE	0.45 µm	6 months*	4°C	HNO ₃ to pH<2
Anions-general	Varies per anion	250 mL HDPE	None	Varies per anion	4°C	None
Acidity/ Alkalinity	100/200 mL	500 mL HDPE	None	14 days	4°C	None
Soil and Sediment						
Volatile Organic Compounds (including Total Petroleum Hyd.)	0.65 kg or 8 ounces	8-ounce glass jar	None	14 days	4°C	None
Semi-volatile Organic Compounds	0.65 kg or 8 ounces	8-ounce glass jar	None	14 days	4°C	None
Acid-Base Accounting	2. kg or 0.5 gallon	1-gallon plastic	None	N.A.	4°C	None
NPK, Sodium Absorption ratio	1. kg or 0.25 gal.	1-gallon plastic	None	N.A.	4°C	None
Metals	Varies per metal	8-ounce glass jar	None	6 months	4°C	None
Whole Rock Analysis	2. kg or 0.5 gallon	1-gallon plastic	None	N.A.	4°C	None
Meteoric Water Mobility	5 gallon	5-gallon plastic	None	None	4°C	None
Air						
Particulate Matter (PM)	Filter	Solid plastic	None	7 days	Ambient temp.	None
Gas	1 liter	Tevlar bag	None	3 days**	Ambient temp.	None

*Aqueous: Mercury= 28 days; Chromium VI= 24 days

Solid: Mercury=28 days; Chromium VI=1 month

HDPE= High-density polyethylene

HNO₃= Nitric acid

NPK= Nitrogen, Phosphorous, and Potassium

** Sulfur compounds =24 hours

N.A.= Not applicable

SECTION 3.0

LABORATORY METHODS AND PROCEDURES

The choice of analytical methods will be influenced by performance criteria, Data Quality Objectives, and regulatory criteria. Once the decision has been made on methods and detection limits to be employed and analyses are underway, the laboratory monitors the precision and accuracy of the results of their analytical procedures through analysis of QC samples. Internal laboratory QC consist of matrix spike analyses, blanks, and matrix spike duplicate analyses. Field QC consist of rinsate blanks, field and trip blanks, and duplicate samples. The laboratory will analyze both internal and field QC preparations.

3.1 Soil and Sediment Analysis

Collected soil and sediment samples will be analyzed by a Nevada-licensed laboratory. Soil and sediment analyses methods and detection limits are listed in Table 3-1, Section 3.7. Depending on the nature of activities associated with a particular mine unit or area, or previous investigation results, soil or sediment samples would be submitted for laboratory analysis of some combination of:

- Total petroleum hydrocarbons (TPH)
- Dissolved and/or total metals
- pH
- Acid-base accounting (ABA)
- Net Acid Generation (NAG) potential
- Meteoric Water Mobility Procedure (MWMP) Profile I
- Agricultural chemistry

Samples specified for agricultural chemistry evaluation will be submitted to a laboratory experienced in the evaluation of soils for use as a growth medium. The samples will be tested for at least the following values:

- Nitrogen, Phosphorus, and Potassium (NPK)
- Boron and Chlorine

- Calcium, Magnesium and Sodium
- Sodium Absorption Ratio (SAR)

Table 2-3, Section 2.8 provides the soil sample minimum collection quantities that are required for laboratory analysis.

3.2 Ground and Surface Water Analysis

Laboratory methods and detection limits for analyses of groundwater and surface water samples will be conducted in accordance with Tables 3-2 and 3-3, respectively. Groundwater and surface water samples will be analyzed for some combination of the following, depending on the nature of activities associated with a particular mine unit or area, documentation of spills or releases in that area, regulatory requests, or previous investigation results:

- Dissolved and/or total metals
- Volatile Organic Compounds (including TPH)
- Semi-volatile Organic Compounds
- Sulfate
- Nitrate
- Chloride
- Acidity
- Alkalinity
- Hardness
- Total dissolved solids

An NDEP-certified laboratory will perform all laboratory analyses.

3.3 Air Analysis

Laboratory methods and detection limits for analyses of air samples will be conducted in accordance with Table 3-4, Section 3.7. Meteorological data that is either collected from on-site stations or from off-site stations may be combined with air sampling results to assess the impact to air quality downwind of certain sources. Air samples will be analyzed for some combination of the following, depending on the nature of activities associated with a particular mine unit or

area, documentation of airborne dust in that area, regulatory requests, or previous investigation results:

- Metals
- Particulate Matter (PM₁₀)

PM₁₀ filters will be weighed prior to and after sampling, after they have been allowed to equilibrate to temperature (between 15 and 30 °C) and humidity (20 to 45 percent) for 24 hours. An EPA-certified laboratory will perform the chemical analyses of the particulate matter collected on the filters on a quarterly basis. Particulate matter will be analyzed for metals using the X-Ray Fluorescence (XRF) Air Filter Analysis with the exception of beryllium, which must be analyzed using atomic absorption analysis.

3.4 Data Package and Reporting Format

The general reporting format for laboratory data packages submitted for data validation may consist of the following sections:

- Case narrative;
- Chain-of-Custody documentation;
- Summary of results for environmental samples (including quantitation limits);
- Summary of QA/QC results; and
- Raw data

As requested, the laboratory will make available for inclusion in their data package the following information:

- Standard Operating Procedures (SOPs)
- Standard Methods used
- Calibration standards and concentrations used
- Description of matrix blanks, replicates, and other QA/QC procedures
- Description of adaptations or modifications of a “standard” method
- References to procedures in other text

3.5 Laboratory QA Requirements - All Analyses

Laboratory sample preparation procedures should be described and standard methods cited and used where possible. The sampling containers, condition of samples received, holding times, holding conditions, number and types of all QA/QC samples to be prepared and analyzed, percent recovery, and name of the laboratory that will perform the analyses need to be specifically referenced.

SOPs provided by each laboratory will be double-checked by Atlantic Richfield to ensure they: are consistent with organizational practices; can serve as training aids; provide ready reference and documentation of proper procedures; reduce work effort; reduce error occurrences in data; and improve data comparability, credibility, and defensibility. The SOPs should be sufficiently clear and written in a step-by-step format to be readily understood by a person knowledgeable in the general concept of the procedure.

SOPs should follow the guidance document Guidance for the Preparation of Standard Operating Procedures EPA QA/G-6. Copies of this document are available through the QAD office as well as the QAD Homepage (<http://es.epa.gov/ncercqa>).

3.6 QC Requirements - All Analyses

Laboratories will analyze all submitted field QC duplicates and blanks. For rinsate blank preparation, refer to Section 2.6. A minimum of one rinsate blank is prepared each day when equipment is decontaminated in the field. Field blank and trip blank preparation is also covered in Section 2.6. A minimum of one field blank is prepared for every 20 samples. A trip blank is required for each sampling event. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. In addition to field QC, laboratories will prepare and analyze internal QC spikes and blanks according to the laboratory's typical QC schedule.

3.7 Methods and Detection Limits - All Analysis

Analysis methods and detection limits for the various matrices are provided in the following tables:

- Soil and sediment analyses: Table 3-1
- Groundwater: Table 3-2
- Surface water: Table 3-3
- Air: Table 3-4

Table 3-1. Laboratory Methods And Detection Limits For Soil And Sediment Analyses				
Parameter or Analyte	Phase*	Method	Detection Limit	Units
Aluminum – ICP-OES	Solid	SW – 846 6010A	0.05	mg/Kg
Antimony – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Arsenic – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Barium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Beryllium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Boron – ICP-OES	Solid	SW – 846 6010A	0.05	mg/Kg
Cadmium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Calcium – ICP-OES	Solid	SW – 846 6010A	0.1	mg/Kg
Chromium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Cobalt – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Copper – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Iron – ICP-OES	Solid	SW – 846 6010A	0.05	mg/Kg
Lead – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Magnesium – ICP-OES	Solid	SW – 846 6010A	0.1	mg/Kg
Manganese – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Mercury – AA Cold Vapor	Solid	SW - 846 7471	0.05	mg/Kg
Molybdenum ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Nickel – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Potassium – ICP-OES	Solid	SW – 846 6010A	0.5	mg/Kg
Selenium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Silver – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Sodium – ICP-OES	Solid	SW – 846 6010A	0.1	mg/Kg
Thallium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Total Petroleum Hydrocarbons	Solid	EPA 8015 Mod EPA 8020 EPA 413.1; 418.1	10	mg/Kg
Total Recoverable Metals – Acid Digestion	Solid	SW – 846 3050A	--	--
Volatile Organic Compounds	Solid	EPA 8240	0.1	mg/Kg
Vanadium – ICP-MS	Solid	SW – 846 6020	1	mg/Kg
Zinc – ICP-MS	Solid	SW – 846 6020	10	mg/Kg

Table 3-2. Laboratory Methods and Detection Limits for Groundwater Analyses

Parameter or Analyte	Phase*	Method	Detection Limit	Units
Alkalinity Total	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Bicarbonate	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Carbonate	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Hydroxide	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Aluminum – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Antimony – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Arsenic – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Barium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Beryllium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Boron – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Cadmium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Calcium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Chloride – Ion Chromatography	Total & Dissolved	EPA 300.0	0.5	mg/l
Chromium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Cobalt – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Copper – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Fluoride - Ion Chromatography	Total & Dissolved	EPA 300.0	0.1	mg/l
Hardness, as CaCO ₃	Total & Dissolved	SM 2340 C	0.1	mg/l (as CaCO ₃)
Iron – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Lead – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Magnesium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Manganese – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Mercury – AA Cold Vapor	Total & Dissolved	EPA 245.1	0.0002	mg/l
Molybdenum -ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Nickel – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Nitrate – N- Ion Chromatography	Total & Dissolved	EPA 300.0	0.05	mg/l N
pH	Total & Dissolved	SM 4500 H+B	1	pH Units
pH - Temperature	Total & Dissolved	SM 4500 H+B	--	°C
Potassium – ICP-OES	Total & Dissolved	EPA 200.7	0.5	mg/l
Selenium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Silver – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Sodium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Sulfate – Ion Chromatography	Total & Dissolved	EPA 300.0	0.2	mg/l
Suspended Solids	Total & Dissolved	SM 2540 D	5	mg/l
Thallium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Total Dissolved Solids	Total & Dissolved	SM 2540 C	10	mg/l
Total Petroleum Hydrocarbons	Total	EPA 8015 Mod EPA 602 or 624 EPA 413.1; 418.1	0.1	mg/l
Turbidity	Total & Dissolved	SM 2130 B	0.1	NTU
Vanadium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Volatile Organic Compounds	Total	EPA 8240	0.1	mg/l
Zinc – ICP-MS	Total & Dissolved	EPA 200.8	0.005	mg/l

Table 3-3. Laboratory Methods and Detection Limits for Surface Water Analyses

Parameter or Analyte	Phase*	Method	Detection Limit	Units
Alkalinity Total	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Bicarbonate	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Carbonate	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Hydroxide	Total & Dissolved	SM 2320 B	1.0	mg/l (as CaCO ₃)
Aluminum – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Antimony – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Arsenic – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Barium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Beryllium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Boron – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Cadmium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Calcium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Chloride – Ion Chromatography	Total & Dissolved	EPA 300.0	0.5	mg/l
Chromium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Cobalt – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Copper – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Fluoride - Ion Chromatography	Total & Dissolved	EPA 300.0	0.1	mg/l
Hardness, as CaCO ₃	Total & Dissolved	SM 2340 C	0.1	mg/l (as CaCO ₃)
Iron – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Lead – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Magnesium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Manganese – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Mercury – AA Cold Vapor	Total & Dissolved	EPA 245.1	0.0002	mg/l
Molybdenum -ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Nickel – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Nitrate – N- Ion Chromatography	Total & Dissolved	EPA 300.0	0.05	mg/l N
pH	Total & Dissolved	SM 4500 H+B	1	pH Units
pH - Temperature	Total & Dissolved	SM 4500 H+B	--	°C
Potassium – ICP-OES	Total & Dissolved	EPA 200.7	0.5	mg/l
Selenium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Silver – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Sodium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Sulfate – Ion Chromatography	Total & Dissolved	EPA 300.0	0.2	mg/l
Suspended Solids	Total & Dissolved	SM 2540 D	5	mg/l
Thallium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Total Dissolved Solids	Total & Dissolved	SM 2540 C	10	mg/l
Total Petroleum Hydrocarbons	Total	EPA 8015 Mod EPA 602 or 624 EPA 413.1; 418.1	0.1	mg/l
Turbidity	Total & Dissolved	SM 2130 B	0.1	NTU
Vanadium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Volatile Organic Compounds	Total	EPA 8240	0.1	mg/l
Zinc – ICP-MS	Total & Dissolved	EPA 200.8	0.005	mg/l

Table 3-4. Laboratory Methods and Detection Limits for Air Analyses				
Parameter or Analyte	Phase*	Method	Detection Limit	Units
Total Petroleum Hydrocarbons	Air	T0-3	0.025	ppm-v
Particulate	Air/Solid	I02.3	1.0	mg
Aluminum	Air/Solid	(XRF) I03.3	*	--
Antimony – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Arsenic	Air/Solid	(XRF) I03.3	*	--
Barium – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Beryllium	Air/Solid	Atomic Adsorption Spectroscopy	8	Ng/cm ²
Boron – ICP-OES	Air/Solid	(XRF) I03.3	*	--
Cadmium – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Calcium – ICP-OES	Air/Solid	(XRF) I03.3	*	--
Chromium – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Cobalt – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Copper – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Iron – ICP-OES	Air/Solid	(XRF) I03.3	*	--
Lead – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Magnesium – ICP-OES	Air/Solid	(XRF) I03.3	*	--
Manganese – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Mercury – AA Cold Vapor	Air/Solid	(XRF) I03.3	*	--
Molybdenum ICP-MS	Air/Solid	(XRF) I03.3	*	--
Nickel – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Potassium – ICP-OES	Air/Solid	(XRF) I03.3	*	--
Selenium – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Silver – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Sodium – ICP-OES	Air/Solid	(XRF) I03.3	*	--
Thallium – ICP-MS	Air/Solid	(XRF) I03.3	*	--
Total Recoverable Metals – Acid Digestion	Air/Solid	(XRF) I03.3	*	--
Volatile Organic Compounds	Air/Solid	T0-14/15	Varies depending on compound	--
Vanadium – ICP-MS	Air/Solid	T0-14/15	Varies depending on compound	--
Zinc – ICP-MS	Air/Solid	T0-14/15	Varies depending on compound	--

ppm-r=parts per million by volume

*detection limits for metals vary depending on element, air sampling flowrate, and area of deposit.

XRF = x-ray fractionalization

SECTION 4.0

HANDLING, DOCUMENTATION AND TRANSPORT

The following sections describe the preparation of samples in the field for transport to the laboratory, including handling, labeling, packaging, documentation, shipment preparation, and custodial quality control.

4.1 Sample Handling and Transport - All Samples

The QA objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging, and shipping are not introducing variables into the sampling chain that could render the validity of the samples questionable. In order to fulfill these QA objectives, duplicate samples, rinsate blanks, and field and trip blanks (Section 2.6) will be used. If the analysis of any QA sample indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QA sample will be evaluated for the possibility of cross-contamination and whether handling and transport procedures were involved.

The following sample packaging and shipment procedures will be followed for the samples to ensure that they are intact when they arrive at the designated laboratory:

- Place a custody seal over each container
- Wrap all glass sample containers in bubble wrap to prevent breakage.
- Place each container in a zip-loc plastic bag and seal the plastic bag shut.
- Place the sealed containers in the appropriate ice chest.
- Empty space in the cooler will be filled with bubble wrap or styrofoam to prevent movement and breakage during shipment.
- Contained ice will be double zip-loc bagged (except for air samples).
- If shipping the ice chest, enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid.
- Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.

- When ice is used, secure the drain plug of the ice chest with fiberglass tape to prevent melting ice from leaking out of the ice chest.
- Label ice chest with “Fragile” and “This End Up” labels.
- Place the shipper label on each cooler with the laboratory address and the return address, and other pertinent information.
- Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery.
- Coordinate deliveries with the laboratory, ensuring that holding times are not violated.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory, in accordance with the corresponding section on sample identification. All sample containers will be placed in a solid, durable shipping container. Insulated ice chests will be used for laboratory samples that must be kept cold. The following outlines the packaging procedures that will be followed:

- Line the bottom of ice chests with bubble wrap to prevent breakage during shipment. A self-adhesive custody seal will be placed across the lid of each sample. For VOC samples, the seal will be wrapped around the cap. All custody seals will be signed and dated.
- All samples will be placed in ice chests with the appropriate traffic report and chain-of-custody forms or RAP packing lists. For ice chests that are shipped, all forms will be enclosed in a large plastic bag and affixed to the underside of the chest lid.
- Ice used to cool samples will be double sealed in two zip-loc plastic bags and placed on top and around the samples to chill them to the correct temperature.
- Each ice chest will be securely taped shut with nylon strapping tape, and custody seals will be affixed over the lid front edge.
- If samples are being shipped, the laboratory will be notified of the sample shipment schedule.

Each shipping label (e.g., Federal Express, UPS) will be completed in full and a copy of the shipping label will be kept on record for the purpose of tracking. Shipping labels will be securely attached to the sample container. Cold samples or samples with less than two weeks holding time will be sent to the laboratory by overnight delivery.

4.2 Field Logbooks

Summary of field measurement and sampling activities will be recorded in a bound site logbook, and entries must contain accurate and inclusive documentation of project activities. Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. A separate logbook will be maintained for each project.

Logbooks will have all pages permanently bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in waterproof black ink, and signed by the individual making the entries. Erasing is not permitted; errors will be single-lined out and initialed and dated. Language will be factual, objective, and free of personal opinions or other terminology which might prove inappropriate.

At a minimum, the following information will be recorded when the applicable procedure is being conducted:

- Sample location and description
- Site sketch showing sample location and measured distances
- References to photograph locations and numbers
- Samplers' name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Sample matrix
- Type of sampling equipment used
- Calibration of equipment described
- Onsite measurement data (e.g., PID, temperature, pH, conductivity, etc.)
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for groundwater: clear water with strong ammonia-like odor)
- Type(s) of preservation used
- Lot numbers of the sample containers, sample tag numbers, chain-of-custody form numbers, and chain-of-custody seal numbers

- Shipping arrangements (overnight air bill number)
- Recipient laboratory(s)

In addition to the logbook, an inventory of observed or reported chemicals could be conducted during site investigation. The inventory would record the type of substance (phase and name, or unknown), type of container, and estimated quantity.

4.3 Photographs

Photographs may be obtained at each field measurement/sampling point, every excavation, select sample locations, and at other areas of interest on site. A reference to each photograph will be entered in the field notebook. When a photograph is taken, the following information will be written in the notebook or will be recorded in a separate field photography log:

- Time, date, and location of photograph
- Description and number of the subject photographed
- Name of person taking the photograph

4.4 Bottles and Preservatives

All containers are from the laboratory and are pre-cleaned for one-time use. Sample containers will not be rinsed prior to sample collection, with the exception of some surface water samples. Preservatives, if required, will be added in the field. Sample container identification and sample preservation methods are covered in Table 2-3, Section 2.8 of this Comprehensive QAPP:

4.5 Sample Traffic Report, Chain-of-Custody, and QA/QC Summaries

Traffic reports and chain-of-custody records are used to document sample collection and shipment to laboratory for analysis. All sample shipments for laboratory analyses will be accompanied by a traffic report and chain-of-custody record. Forms will be completed and sent with the samples for each laboratory and each shipment. If multiple insulated sample chests are sent to a single laboratory on a single day, a form for each chest will be completed and sent to

the laboratory. The traffic report and chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples.

Each chain-of-custody will contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Filtration completed or required
- Method of shipment

A record of quality assurance/quality control (QA/QC) will be maintained in the field notebook. Sample numbers for all rinsate samples, reference samples, blanks, QC samples, and duplicates will be noted in the notebook.

SECTION 5.0

INSTALLATION PROCEDURES

5.1 Installation of Monitoring Wells

All monitor well boreholes will be drilled using a drilling technique that allows for lithologic logging of borehole samples to assist in the assessment of site hydrostratigraphy. All wells will be constructed to allow for the collection of groundwater elevation measurements and water quality samples. The Data Summary Report for groundwater Conditions will present all pertinent information from the well drilling and construction activities.

The wells will be constructed of two-inch diameter, Schedule 40 PVC flush-coupled well casing and 0.02-inch slotted screens. Screened intervals (of a length to be determined in each Work Plan) will be installed in the saturated alluvium with a filter pack consisting of 10/20 silica sand. The filter pack will be extended above the static groundwater level measured in the borehole to an elevation sufficient to capture the estimated highest seasonal elevation of the groundwater table plus two feet.

The remaining annulus will be backfilled with bentonite or grout to the natural ground surface. The wells will be completed with either (a) a nominal two-foot casing above the ground surface or (b) a subsurface casing within a manhole or vault. The type of completed well will depend on the location and traffic within the area. All completed wells will be cemented in-place and locking caps installed at the top of the well casings.

Measurement of latitude/longitude coordinates and top-of-casing elevations for existing and new monitor wells will be conducted with a real-time kinematic global-positioning satellite (GPS) device. This portable device allows an accuracy of at least three millimeters (0.01 feet) for latitude, longitude, and elevation. This degree of accuracy is sufficient for water level measurements to be used in the calculation of groundwater direction and hydraulic gradient. Measurements of coordinates and elevations will be recorded in the field notebook immediately after readings are observed, and will be automatically logged in the GPS data-logger for later down-loading and cross-checking of data recorded in the field. The coordinates will be used to properly position the wells on a site plan, along with a permanent record of each well top-of-

casing elevation. For the purpose of field measurement, the top of the well casing will be the highest point on the rim of the casing.

5.2 Installation of Soil Moisture Devices

Soil moisture sensors will be placed in boreholes drilled to a predetermined depth below ground surface (bgs). Boreholes will be drilled with the smallest diameter auger possible, to allow for closest proximity with native soil. The diameter of the soil moisture sensors is approximately 1.5 inches. Soil cuttings or core borings will be saved for laboratory analysis of soil moisture and for sensor installation. Sensors will be installed at predetermined depth intervals as specified in the appropriate Work Plan.

The following procedure should be used to install the soil moisture sensors (NOAA, 2002; UMES, 1999):

1. Soak each sensor in clean water for 1 to 2 hours to remove the air and then allow drying for 4 to 6 hours. Repeat this step two times more.
2. Prior to placing sensors into the soil soak at least five minutes.
3. To install a sensor in the soil, first make a hole with a soil probe or auger to a depth a little deeper than desired.
4. To get good sensor contact with the soil, mix native soil from auger cuttings with enough distilled water to form four gallons of thick, semi-fluid mud with no visible air gaps.
5. Pour one gallon of mixed mud into the boring.
6. Position the sensor into the hole by lowering the sensor to the desired depth until the bottom of the sensor touches the mud.
7. Fill the hole around the sensor by adding the remaining three gallons of mixed mud, then some dry native soil and a little water at a time to enhance compaction, until the hole is filled to the depth of the next sensor level.
8. Allow at least one week for equilibration of the mud with surrounding native soil before recording the first "true" soil moisture measurements. To ensure equilibration, record the change in soil moisture every 12 hours, and graph results until the curve becomes relatively asymptotic.
9. Mark each sensor lead with a permanent tag indicating the exact depth of the sensor. Allow a minimum of six feet of lead to protrude from the ground surface.
10. Install an eight-inch diameter steel casing around the wire leads. The casing should extend from a minimum of one-foot bgs to two-feet above ground surface, and be open at the top, with no cap.

It is not a requirement that the sensor be calibrated directly with soil from each sensor location in each borehole. However, since soil profiles are typically made up of varying concentrations of elements and have different electrical properties, sensor accuracy is improved by soil-specific calibration. The improvement in accuracy due to soil-specific calibration has been estimated at approximately one percent.

Calibration is accomplished by collecting a soil sample (auger cutting or core boring) from each interval where a sensor will be placed, and pushing the sensor into the soil sample and recording the reading. The sample will then be laboratory-analyzed gravimetrically for water content. These laboratory data are combined with the sensor's electrical measurements to develop a soil-specific calibration equation.

Each lead from each sensor will be plugged into the meter, and soil moisture recorded. Readings from the meter will be inserted into the calibration equation to determine the true volumetric soil moisture. Data collected from the moisture sensors are analyzed by graphing the measurements. A series of readings taken over time are plotted to show changes in moisture level and trends throughout the soil profile.

5.3 Installation of Air Quality Monitoring Devices

The proposed air quality and sampling program at the Yerington Mine site has been developed according to the NDEP -- Bureau of Air Quality Monitoring Guidelines. PM₁₀ Samplers will be of the same type having the same inlet type and flow control. Inlets on all samplers will be between the range of 2 to 15 meters above ground and be at least 2 meters away from all structures possible obstructions to airflow. Samplers should be mounted on solid, stable structures that will not be moved by strong winds.

Also, there must be a minimum of a 270-degree arc of unrestricted airflow around each sampler. The predominant wind direction for the season of greatest pollutant concentration potential from the facility must be included in the 270-degree arc (NDEP, 2000).

Locations and Monitoring Pathways

Each monitoring site location will be as specified in the Work Plans. Monitoring path limitations are necessary in order to produce a path concentration representative of the measurement scale and to limit the averaging of peak concentration values. In addition, the selected path length (distance between the emission source and the sampling device) should be long enough to encompass plume meander and expected plume width during periods when high concentrations are expected.

To ensure that monitoring path data are representative of the intended monitoring objective(s), specific path siting criteria are needed. 40 CFR part 58, Appendix E, contains specific location criteria applicable to monitoring paths after the source and sampling locations have been identified. Criteria for the monitoring path are given for horizontal and vertical placement, spacing from minor sources, spacing from obstructions, spacing from trees, and spacing from roadways.

To control the sum effect on sample collection from all the possible interferences which exist around the monitoring path, the portions of a monitoring path that are affected by obstructions, trees, or roadways must not exceed 10 percent of the total monitoring path length (EPA, 1998c).

Mid-volume sampling will be conducted, with a flow rate of 113 L/min (4 ft³/min). Teflon filters (47mm diameter) will be used, to facilitate XRF spectroscopy for metals analysis. All calibrations, sampling, and analysis will be conducted in identical manners for all samplers.

During installation, certain information should be recorded from the samplers and filters. This information includes the following:

- Sampler identification (serial # or other ID)
- Run date
- Filter serial number
- Elapsed run time (minutes)
- Actual flow rate (m³/min)
- Standard flow rate (m³/min)
- Tare filter weight (g)

5.4 Installation of Meteorological Stations

Selection of the meteorological station should consider those obstructions that can affect instrument performance, such as vegetative canopy, water bodies, frequent dust storms, and buildings or other structures. Meteorological station equipment will be mounted to a tripod with a maximum height of 10 feet. The base diameter of the tripod is 10 feet. The leg configuration of the tripod will be adjustable for uneven terrain. The unit should withstand a sustained wind of 70 miles/hour and gusts of 100 miles/hour.

In general, the meteorological station instruments will be installed according to the manuals supplied by the manufacturers. The major components of the meteorological station may include:

- Control system and datalogger.
- Charger and regulator.
- Transformer.
- Sealed rechargeable battery with mounting.
- Weatherproof enclosure with conduit.
- 20-watt solar panel (optional).
- 10 foot tripod with grounding kit.
- Wind Monitor for recording wind speed and direction.
- Wiring
- Aluminum crossarm sensor mounts.
- Temperature/RH probe
- Solar radiation shield for temperature and RH probe.
- Silicon pyranometer (optional; this instrument is typically used in solar radiation applications such as plant growth and evapotranspiration investigations).
- Rain gage
- Tipping bucket snowfall adapter with antifreeze.
- Interface and serial cable for downloading data.
- Datalogger software.

The data logger attached to the instruments will be initially programmed to sample every 2-seconds and write data every 10-minutes and at 24-hours. Depending upon the desired data

output, the data logger sampling program can be modified. If the data from the station is to be used in conjunction with ambient air sampling data for air quality purposes, then the amount of "down" time (for maintenance or calibration) should be observed and documented. The down time should be limited to equal to or less than 10% of the total time frame over which air quality monitoring is being conducted. This is in accordance with Nevada Ambient Air Quality Monitoring Guidelines, which state that "all meteorological data collected will be recovered at a minimum rate of 90% of the total data possible on an annual basis for each variable being measured" (NDEP, 2000).

Hourly averages of meteorological parameters are required to be reported to the Nevada Bureau of Air Quality. For meteorological monitoring data, the Nevada Ambient Air Quality Monitoring Guidelines state that "at least 30 minutes of valid observations are required to represent an hourly average. If 15-minute averages are used for compiling meteorological data, then at least two valid 15-minute periods are required for an hourly average. The minimum meteorological data sampling frequency of 360 samples per averaging period is met by electronically sampling equipment output at least once every 10 seconds for hourly averages or at least once every 2.5 seconds for 15-minute averages. A sampling frequency of once every two seconds is recommended (NDEP, 2000).

Maintenance and Calibration

The manufacturers' recommended maintenance and calibration methods for various meteorological components are described below. The wind monitoring instrument will need to be sent to a lab once per year for inspection.

- RM Young 05305 Wind Monitor-AQ – Have qualified lab inspect bearings annually.
- Model SP-LITE pyranometer – Routine cleaning, no special requirements.
- Model TE525WS 8-inch diameter rain gage – Routine cleaning in the field, optional lab calibration annually.
- CS705 snowfall adapter for the TE525WS 8-inch diameter rain gage – Routine cleaning in the field and periodic changing and disposal of antifreeze.
- Model HMP45C temperature and relative humidity probe – Routine cleaning in the field.
- Electrical Equipment – Keep free of moisture.
- Batteries – Periodically check fluid and charge, change when necessary.

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ATLANTIC RICHFIELD COMPANY

**CLOSURE SCOPE OF WORK
FOR THE
YERINGTON MINE SITE
MARCH 29, 2002**

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SECTION 1.0

INTRODUCTION

Atlantic Richfield Company has prepared this Closure Scope of Work (SOW) to close the Yerington Mine site. Site investigations presented in this SOW will provide the technical foundation for the development of a Final Permanent Closure Plan (FPCP) that will meet the closure objectives listed below. Site investigations (i.e., short-term actions) requested by the U.S. Environmental Protection Agency and the U.S. Bureau of Land Management have been incorporated into the applicable sections of this SOW.

The proposed site investigations will collect the data necessary to develop and evaluate closure alternatives. Site investigations and closure alternatives will be conducted and evaluated in the context of human health and ecological risk. Data collection activities will be tailored to provide information relevant to the development, evaluation and implementation of closure alternatives. Closure alternatives will be screened against the appropriate evaluation criteria.

1.1 Previous Site Investigations and Interim Closure Activities

Atlantic Richfield Company has previously taken steps to improve site conditions, protect human health and the environment and, most recently, to attempt to reach final site closure. These steps date back to 1985 and have been conducted under an Administrative Order by the Nevada Division of Environmental Protection – Bureau of Corrective Actions (NDEP), and are listed below:

- Installed and operated pumpback system to manage shallow groundwater from 1985 to the present;
- Implemented pumpback system improvements in 1998, 1999 and 2001 including the installation of six new pumpback wells, re-compaction of the evaporation pond in 1998 and the relining of two evaporation pond cells with high-density polyethylene liners;
- Monitoring of groundwater quality and groundwater elevations in approximately 23 wells in the area from 1985 to the present;
- Ongoing financial and technical support for NDEP site management activities since Arimetco abandoned operations at the site;

- Submittal of annual monitoring and operation reports;
- Submittal of a Shallow Groundwater Data Evaluation Report in 2000;
- Conducted hydropunch groundwater monitoring with cooperation by the U.S. Bureau of Land Management (BLM), NDEP, Lyon County and others in 1999;
- Provided financial support to NDEP to cap areas of red material disturbed by Arimetco that were observed as dust concerns on two different occasions; and
- Agreed to conduct the following site investigation activities (short-term actions) requested in 2001 by EPA and BLM:
 - Quarterly monitoring of specific wells;
 - Hydropunch sampling;
 - Domestic well sampling;
 - Evaluation of Wabuska Drain; and
 - Evaluation of EPA air pathway data and installation of a meteorological station.

1.2 Closure Objectives

Closure objectives at the Yerington Mine site are stated as follows:

- Containment and management of existing and potential future impacts to groundwater;
- Assessment and, if required, containment of fugitive dust;
- Address physical and chemical stability of all surface mine materials;
- Demonstration that mine closure units and affected off-site areas following closure and reclamation activities will not adversely affect human health or the environment; and
- Establishment of a compatible post-closure land use and related monitoring and maintenance plan.

The collection of the data specified within this SOW will allow for the development of a comprehensive FPCP that meets these closure objectives. The site conceptual model and Work Plans will incorporate the processes suggested by NDEP, BLM and EPA to achieve these closure objectives. Ecological and human health risk, including exposure pathways and receptors, and post-closure land use will be considered during site conceptual model development and evaluated in the FPCP.

1.3 Site Location and Background

The Yerington Mine site is located approximately one mile west of the town of Yerington in Lyon County, Nevada (Figure 1). Beneficiation operations were conducted between 1953 and 1978 for oxide and sulfide copper ores extracted from the open-pit mine in the southern portion of the mine site. Waste rock and tailings areas exist to the north of the open pit. Waste rock areas exist to the south and north of the open pit. Evaporation ponds were also constructed at the site.

In 1989, Arimetco International expanded leaching operations in the southern, central and western portions of the site, which included the construction and operation of an electrowinning plant located near the mill area. Leach pads and solution ponds were also constructed in the oxide tailings areas and cover all but the northern end of the former unlined evaporation ponds.

1.4 Work Plans, Data Summary Reports and Closure Plans

Atlantic Richfield Company will develop and implement Work Plans to conduct site investigations at the Yerington Mine site for each site closure issue and mine closure unit identified in Tables 1 and 2, respectively. The distribution, review and approval process is anticipated to follow the process under development within the Memorandum of Understanding between the regulatory agencies. One or more Work Plans may be combined into a single Work Plan, as appropriate. All site investigations will be summarized in Data Summary Reports, which will provide the basis for a site-wide FPCP to be developed and submitted for approval prior to implementation. Prior to conducting site investigations, a Health and Safety Plan will be submitted for review and approval.

The FPCP will provide the basis for implementation of closure activities at the Yerington Mine site. The FPCP will address all surface units (e.g., evaporation ponds, leach pad, tailings and waste rock areas) and general site conditions (e.g., groundwater and air quality) including affected off-site areas. The FPCP will include site location and background information, a description of each mine closure unit, characterization data, the proposed method(s) necessary to achieve physical and chemical stability, and an implementation schedule for final closure activities. As necessary, treatability studies will be performed to support site closure. An evaluation of the potential risk to human health and the

environment will be conducted within the FPCP. All proposed closure alternatives will be screened against the following criteria within the FPCP:

- Economic (cost);
- Long-term effectiveness and performance;
- Cost-effective reduction of toxicity, mobility and volume of constituents of concern;
- Overall protection of human health and the environment;
- Implementability;
- Short term impacts;
- Public acceptance;
- State acceptance; and
- Risk-based evaluation.

1.5 Closure and Reclamation

The intent of closure and reclamation at the site is to meet the objectives listed in Section 1.2. Appropriate closure and reclamation activities will be developed upon the evaluation of data collected pursuant to this Scope of Work. The data developed under this SOW, combined with the existing data, will be critical in the development, evaluation and implementation of closure and reclamation activities.

SECTION 2.0

SITE INVESTIGATION APPROACH

This section describes the approach to investigating the general site conditions and specific facilities at the Yerington Mine site. Proposed investigation activities and the rationale for the activities are provided in Tables 1 and 2. An evaluation of existing data will be conducted, and summarized in a Work Plan along with the details for the specific data collection activities. Collection of new data in support of mine closure will be implemented only after all pertinent information has been compiled and evaluated. Although not a site investigation activity, development of a Community Relations Plan is also included in Table 1 and described in this section.

Work Plan implementation and the results of site-specific and general site investigation activities will provide the technical basis for the FPCP. Physical and geochemical characteristics of each mine closure unit, and its hydrogeologic setting, will be evaluated in the context of the site closure objectives described above. If these investigations identify surface materials that have the potential to degrade waters of the State, or pose a risk to human health or the environment, then appropriate additional site characterization and/or mitigation or closure measures will be conducted to evaluate air pathways, surface water pathways and groundwater pathways. Ecological and human health risk will be assessed for identified sources, pathways and receptors. If a mine closure unit is shown to have no potential to degrade groundwater, or does not pose a threat to human health or the environment, no further investigations will be conducted.

Site investigation activities for mine closure units will be based upon the unit's type, operational history, material characteristics and/or hydrogeologic setting. The following site closure issues and mine closure units for the data review and/or site investigation process have been identified:

Table 1. Proposed Site Investigations at the Yerington Mine: Site Closure Issues

Site Closure Issue	Investigation Activities	Rationale for Investigation
Conceptual Site Model	Data review and discussion of site technical issues: evaluation of exposure pathways and potential receptors: definition of mine closure units.	To provide the basis for future site investigations, data quality objectives, and Work Plan development.
Fugitive Dust	Install Air Monitoring Station(s). Evaluate EPA air pathway data.	Evaluation of particulates and metals resulting from wind-blown dust and collection of baseline/background data.
Cover Materials Characterization	Collect soil samples for analyses: quantify soil volumes.	Suitable soils can be used to cap facilities to support closure and future land use.
Stormwater Management	Evaluate aerial topographic and ortho-photo data.	To aid the development of post-closure stormwater management.
Site Water Balance	Analyze existing meteorologic data (e.g., precipitation, evaporation).	Water balance data will support groundwater management and closure decisions.
Groundwater Conditions	Evaluate existing groundwater data and, if required, conduct hydroponch sampling and design additional monitor wells to collect water elevation and chemical data. Quarterly monitoring of specific wells. Evaluate background data.	Data to be used in the evaluation of hydrogeochemical conditions to support closure activities and improve understanding of constituents of concern in groundwater.
Wabuska Drain	Collection and evaluation of hydrologic and geochemical data.	Data to be used to evaluate water quality and ecological and human health risk.
Community Relations Plan	Establish criteria for Community Relations Plan.	Inform members of Yerington and surrounding communities of mine closure activities.

Table 2. Proposed Site Investigations at the Yerington Mine: Mine Closure Units

Mine Closure Unit	Investigation Activities	Rationale for Investigation
Waste Rock Area (south of pit)	Collect waste rock samples for geochemical and geotechnical analyses.	Data to be used to evaluate borrow source feasibility.
Yerington Pit and Pit Lake	Review existing pit lake hydrologic and geochemical data: review hydrogeologic data of the bedrock and alluvial groundwater flow system filling the pit.	Data to be used to identify data gaps and/or management alternatives.
Waste Rock and Tailings Area (north of pit)	Collect waste rock and tailings material samples for geochemical and geotechnical analyses.	Data to be used to evaluate facility closure options.
Mill Area and Precipitation Plant	Collect soil samples for geochemical analyses. Evaluate structures for closure.	Data to be used to support closure alternatives and evaluation of potentially affected soils.
Oxide Tailings Area	Collect samples for geochemical and geotechnical analyses.	Data to be used to evaluate closure options.
Sulfide Tailings Area	Collect samples for geochemical and geotechnical analyses.	Data to be used to evaluate closure options.
Arimetco Leach Pads and Process Components	Collect leached material (spent ore) samples for geochemical and geotechnical analyses. Evaluate structures for closure.	Data to be used to evaluate closure options.
Evaporation Ponds	Evaluate underlying soils and groundwater conditions.	Assess potential for groundwater impacts and optimization of existing pumpback system.

2.1 Conceptual Site Model

A conceptual site model will be developed that establishes the basis for subsequent Work Plans and site investigations. The conceptual model will further define mine closure units through mapping and field verification. Mine closure units are currently defined in Table 2, which can be modified as site investigations proceed. Identified units can be sub-divided or more units added through this process. The conceptual site model will evaluate migration and exposure pathways for surface water, groundwater and air potentially affected by the mine units, and identify potential on-site and off-site receptors in terms of ecological and human health risk. If site investigations indicate that off-site areas have been affected, then the off-site area will be evaluated by the Work Plan for that unit, including an assessment of possible human health or ecological risk.

The conceptual site model will also establish data quality objectives (DQOs) for the site investigations described in this section, and listed in Tables 1 and 2, to help focus data collection activities to collect appropriate data necessary to meet the stated closure objectives. Conceptual model development will include a review of relevant data and literature, a review of past and recent aerial photographs, and pertinent anecdotal information (e.g., interviews with former employees).

2.2 Fugitive Dust

Fugitive dust from existing surface facilities at the Yerington Mine site has been observed at certain times. An evaluation of existing meteorologic data in the vicinity of the site will be performed and, on the basis of the data review and empirical observations of fugitive dust sources, Atlantic Richfield will install one or more air monitoring stations. A Work Plan for fugitive dust air monitoring will be prepared and submitted for approval.

The air monitoring station(s) will be strategically located to provide an assessment of fugitive dust that exits the site property boundary. Parameters to be monitored and monitoring intervals/schedule will be developed in the Work Plan. Atlantic Richfield Company will evaluate controls for fugitive dust sources based on the air monitoring data. Source control measures will be integrated with facility specific characteristics in support of site closure objectives.

Upon receipt from EPA, Atlantic Richfield Company will evaluate data collected by EPA on site visits conducted on April 25 and June 19, 2001. Based on this review, additional data collection requirements will be determined. In addition, Atlantic Richfield Company proposes to evaluate existing meteorologic data for the site and install one meteorological station. The meteorological station will be strategically located to provide useful meteorological data relevant to the site. Results of this investigation, including meteorological data, will be presented in the Data Summary Report.

2.3 Cover Materials Characterization

An evaluation of potential cover materials from alluvial borrow sources and from existing mine units for use in potential site closure activities will be conducted. Characterization of cover materials will include an inventory of available material type including volume estimates, the collection of representative samples, and laboratory analyses. Geotechnical analyses will include grain size, moisture content, density, compaction characteristics or other physical analyses. Geochemical analyses may include whole rock chemistry and agricultural parameters to assess the ability to support vegetation or other chemical analyses. Sampling locations, analytical parameters and methods will be specified within the Work Plan.

The locations, volume and geotechnical characteristics of suitable cover materials will be presented in a Data Summary Report. This information will be used to support site re-grading and closure designs.

2.4 Stormwater Management

Based on recent site aerial photography and topographic mapping (2-foot contours at a scale of 1 inch = 100 feet), an evaluation of the need to develop re-grading plans for stormwater management activities will be performed. As necessary, within the FPCP, stormwater management activities will be integrated with the closure objective of attaining physical and chemical stability for all mine closure units. Such activities will be supported by run-off calculations and site-specific meteorologic data.

2.5 Site Water Balance

Atlantic Richfield Company will evaluate existing meteorologic data (e.g., precipitation and evaporation) to determine the need to collect additional site-specific data. Existing and new data will be integrated with the cover designs and re-grading plans within the FPCP to manage stormwater run-off at the site. A comprehensive water balance database will also support management decisions for facility and overall site closure, including the optimization of groundwater pumping from the shallow aquifer. The meteorologic data will be compiled the FPCP, and will aid in the development of closure options.

2.6 Groundwater Conditions

An evaluation of current groundwater management operations and aquifer conditions in the context of site water balance information will be conducted including an assessment of the effectiveness of the pumpback well system. This review will include the identification of areas at the mine site, located down-gradient of surface features with the potential to impact groundwater, that have little or no groundwater monitoring data. The results of this evaluation will be summarized in a Work Plan that will present the locations and preliminary designs for additional monitor well construction. Piezometers may also be specified within the Work Plan to aid in evaluating groundwater elevations at certain locations. The monitoring schedule and analytical parameters for new and existing wells will also be included within the Work Plan. Separate Work Plans have already been submitted for hydropunch evaluation and trench testing of groundwater conditions associated with the Pumpback Well System. However, other activities may be incorporated into the Work Plan in the future.

As part of site groundwater investigations, Atlantic Richfield Company will conduct quarterly sampling and analysis of specific constituents from groundwater monitor wells located within and down-gradient of the Yerington Mine site during four consecutive quarters. Details such as locations, analytical parameters, etc. will be specified within the Groundwater Conditions Work Plan. The purpose of this investigation is to provide more current groundwater quality data within and around the site, particularly in the shallow aquifer. The investigation will also provide additional data to aid in the evaluation of the effectiveness of the current Pumpback Well System. Data Summary Reports will be prepared pursuant to a yet-to-be selected regulatory mechanism that will provide the analytical results of this one-year investigation.

Additional monitor well installations may be implemented after a detailed review of existing hydrogeologic conditions and groundwater quality data from the existing monitor well network and the area down-gradient of the Pumpback Well System. As requested by EPA and BLM in the July 2001 General Notice Letter, two additional monitor wells are anticipated to be installed as Short-Term actions. One well will monitor groundwater from the area near the intersection of Locust Lane and Luzier Lane. The second well would replace an existing shallow aquifer monitor well, USGS-13, that is currently nested with a monitor well completed in a deeper aquifer.

In addition to the hydrogeologic investigations described above, Atlantic Richfield Company will also re-sample domestic wells from residences previously sampled by EPA at down-gradient locations from the Yerington Mine site. The sampling and analysis protocols, the list of analytical parameters and other details will be specified in the Groundwater Conditions Work Plan. Results of domestic well sampling and analysis activities will be presented in the Data Summary Report.

2.7 Waste Rock Area (South of Pit)

An estimate of the extent of waste rock materials will be conducted using available historical information. Materials characterization may include one or more of the following sequential steps: materials inventory and static testing. Characterization of waste rock materials will follow guidelines approved for the Work Plan for this mine closure unit.

Waste rock materials to be sampled and analyzed will be based on color, degree of oxidation, lithology, secondary mineralization, alteration intensity, and mineralogic characteristics. Representative samples will be collected and analyzed using the appropriate method. The physical and chemical stability of waste rock materials will be determined on the basis of: 1) surface run-off; 2) depth to groundwater; 3) hydrogeology; 4) geochemistry; and 5) water balance calculations or modeling. Additional investigation activities and/or closure measures to eliminate, or minimize, the potential to degrade waters of the State or otherwise pose a risk to human health or the environment would be incorporated in the FPCP.

2.8 Yerington Pit and Pit Lake

The Yerington Pit has penetrated the bedrock groundwater flow system and the alluvial flow systems, and the associated pit lake will be evaluated for potential impacts to groundwater and/or the potential to pose an ecological or human health risk. Specifically, the Nevada Administrative Code NAC 445A.429 states that “Bodies of water which are a result of mine pits penetrating the water table must not create an impoundment which has the potential to degrade the ground waters of the state or has the potential to affect adversely the health of human, terrestrial or avian life.” An evaluation of existing data and the collection of additional data, if necessary, will aid in the development of closure and management alternatives for the pit lake.

2.9 Waste Rock Area (North of Pit)

An estimate of the extent of waste rock materials will be conducted using available historical information. This area includes leached materials and low-grade ore stockpiles. The intent of the materials mapping will be to provide the basis for materials sampling and analysis as the first phase of facility characterization. If a complete delineation of specific material types is not possible, Atlantic Richfield Company will present assumptions as to the extent of material types to NDEP for approval prior to materials characterization. Materials characterization may include one or more of the following sequential steps: materials inventory and static testing.

Characterization of waste rock and tailings materials will be performed per guidelines specified in the Work Plan for this mine closure unit. Waste rock materials to be sampled and analyzed will be based on color, degree of oxidation, lithology, secondary mineralization, alteration intensity, and mineralogic characteristics. Representative samples will then be selected based on the relative proportions of material types and analyzed using the appropriate method. The physical and chemical stability of waste rock and tailings materials will be determined on the basis of: 1) surface run-off; 2) depth to groundwater; 3) hydrogeology; 4) geochemistry; and 5) water balance calculations or modeling. Additional investigation activities and/or closure measures to eliminate, or minimize, the potential to degrade waters of the State or otherwise pose a risk to human health or the environment would be incorporated in the FPCP.

2.10 Mill/Process Area and Precipitation Plant

Soils in the mill/process and precipitation plant areas will be characterized with respect to their potential to pose a risk to human health or the environment. These areas include on-site process buildings, ditches, tanks and vats. Generally, soils will be analyzed for whole rock chemical analyses. The soils characterization program will be used to support the final closure plan for the process areas.

The FPCP will identify buildings or equipment fixtures will be subject to demolition, cover and/or removal and disposal of debris. Beneficiation units that contain materials or significant material residues that may impact groundwater or pose a risk to human health will be inventoried, characterized and evaluated for closure alternatives (e.g., removal, isolation, or mitigation). Units that may have the potential to impact surface runoff may be subjected to additional characterization and/or closure options as necessary to eliminate or minimize potential impacts.

2.11 Oxide Tailings Area

An estimate of the extent of oxide tailings materials will be conducted using available historical information. The intent of the materials mapping will be to provide the basis for materials sampling and analysis as the first phase of facility characterization. Mapping of historic drainage ditches will be included. Materials characterization may include one or more of the following sequential steps: materials inventory and static testing.

Characterization of oxide tailings materials will be performed per guidelines specified in the Work Plan for this mine closure unit. Representative samples will be collected and analyzed using the appropriate method. The physical and chemical stability of oxide tailings materials will be determined on the basis of: 1) surface run-off; 2) depth to groundwater; 3) hydrogeology; 4) geochemistry; and 5) water balance calculations or modeling. Additional investigation activities and/or closure measures to eliminate, or minimize, the potential to degrade waters of the State or otherwise pose a risk to human health or the environment would be incorporated in the FPCP.

2.12 Sulfide Tailings Area

An estimate of the extent of sulfide tailings materials will be conducted using available historical information. The intent of the materials mapping will be to provide the basis for materials sampling and analysis as the first phase of facility characterization. Mapping of historic drainage ditches will be included. Materials characterization may include one or more of the following sequential steps: materials inventory and static testing.

Characterization of sulfide tailings materials will be performed per guidelines specified in the Work Plan for this mine closure unit. Representative samples will be collected and analyzed using the appropriate method. The physical and chemical stability of sulfide tailings materials will be determined on the basis of: 1) surface run-off; 2) depth to groundwater; 3) hydrogeology; 4) geochemistry; and 5) water balance calculations or modeling. Additional investigation activities and/or closure measures to eliminate, or minimize, the potential to degrade waters of the State or otherwise pose a risk to human health or the environment would be incorporated in the FPCP.

2.13 Arimetco Leach Pads and Process Components

As required, the spent ore materials contained within the Arimetco leach pads will be evaluated in a similar fashion as the tailings and waste rock facilities described above. Atlantic Richfield Company will prepare a Work Plan that outlines such characterization steps as the performance of static and kinetic tests, analysis of whole rock geochemistry, and the collection hydraulic parameters of pad materials. Given that these facilities are lined, and should not have significant potential to degrade waters of the State, a limited materials characterization program is anticipated. Process components associated with the leach pads such as ponds, ditches, tanks, the electrowinning facility, etc. will also be investigated. Hydraulic modeling of one or more representative pads may be conducted to demonstrate the long-term water balance for these facilities.

2.14 Evaporation Ponds

The unlined evaporation pond has resulted in mining-related groundwater issues within the Yerington Mine site, and is subject to the AO resulting in the Pumpback Well System. Other lined and unlined ponds, and historic drainage ditches, will be evaluated for potential impacts to human health and the

environment. Representative samples of solids accumulated in the ponds will be analyzed in a similar fashion as performed for the tailings and waste rock areas. Collection of these data will aid in the development of closure options for the ponds.

2.15 Wabuska Drain Evaluation

Contingent upon receiving access from property owners and Work Plan approval, Atlantic Richfield Company will conduct a hydrologic and geochemical assessment of the Wabuska Drain. Up to four monitoring locations will be identified for flow measurements and the collection of surface water samples and soil samples for laboratory analysis. Details such as sample locations, analytical parameters, etc. will be included in the Work Plan for this mine closure unit. Results of this investigation will be presented in a Data Summary Report.

2.16 Community Relations Plan

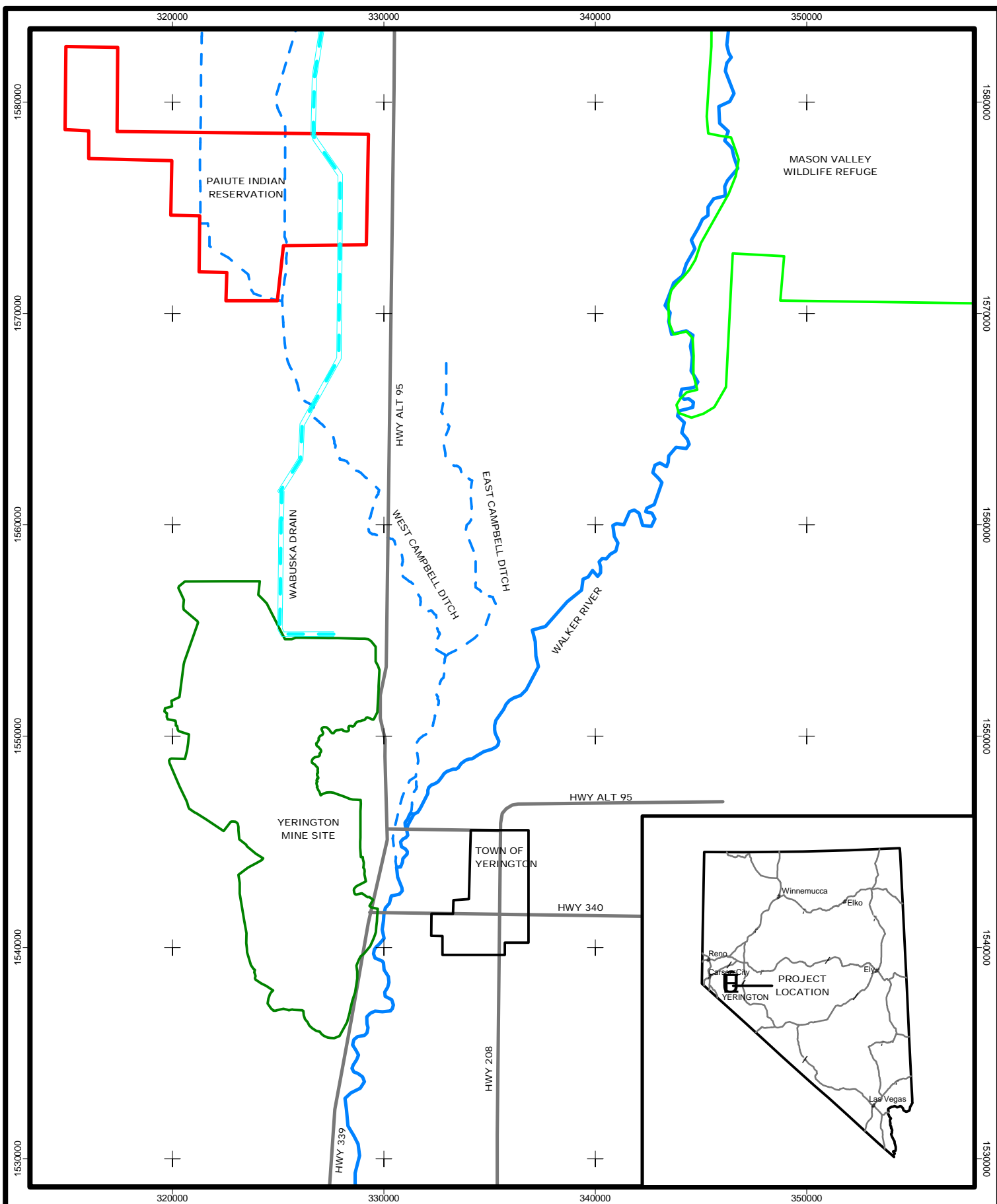
The YTWG will develop a community relations plan to provide local residents and communities with up-to-date information regarding the results of site characterization activities and closure plans for the Yerington Mine site. This plan will provide for distribution of printed information and conduct of public meetings in Yerington.

SECTION 3.0

SCHEDULE OF SITE INVESTIGATION ACTIVITIES

Atlantic Richfield Company plans to initiate these SOW activities at the Yerington Mine site in 2002. A preliminary schedule of Work Plan development is attached. This preliminary schedule is subject to modification as investigations proceed. EPA and BLM requested in the July 2001 General Notice Letter that certain "Short Term" actions be conducted as soon as possible. These Short Term actions are listed below and are being implemented on an accelerated schedule as specified in Atlantic Richfield's letter response dated February 5, 2002. However, the following Short Term actions have been included in the appropriate sections of this SOW, and are anticipated to be folded within the SOW activities as they get underway:

- Site-wide quarterly groundwater monitoring consisting of the existing groundwater wells on and near the site;
- Installation of at least two monitoring wells in the north and northwest site boundary areas;
- Bi-annual domestic groundwater well sampling of wells previously sampled by EPA;
- Sampling of the Wabuska Drain; and
- Evaluation of EPA air pathway data and installation of a meteorological station.



NOTES:
1.) PROJECTION: NEVADA STATE PLANE, WEST ZONE
1927 NORTH AMERICAN DATUM (FEET)

BROWN AND CALDWELL
Carson City, Nevada

DATE: SEPTEMBER 2002

Atlantic Richfield Company

PROJECT NUMBER: 21243

SCALE:
2000 0 2000 4000 Feet
1:72000



FIGURE 1
SITE LOCATION